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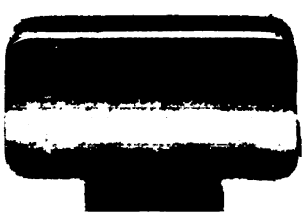

GENERAL LAND OFFICE.

MANUAL OF INSTRUCTIONS

FOR THE

SURVEY OF THE MINERAL LANDS OF THE UNITED STATES.

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MANUAL OF INSTRUCTIONS FOR THE SURVEY OF THE MINERAL LANDS OF THE UNITED STATES.

DEPARTMENT OF THE INTERIOR,
GENERAL LAND OFFICE,
Washington, D. C., September 11, 1908.

TO UNITED STATES MINERAL SURVEYORS.

SIRS: These regulations are chiefly compiled from the practice of the various surveying districts, no changes or additions being made, except where necessary to secure uniformity and to conform to present interpretations of the law.

You are expected to strictly comply with these instructions, and no survey will be accepted or approved by the surveyor-general until all the requirements herein have been fully met.

Very respectfully,

FRED DENNETT,
Commissioner.

Approved, October 6, 1908.
FRANK PIERCE,
First Assistant Secretary.

GENERAL INFORMATION.

APPOINTMENTS.

1. Under section 2334, United States Revised Statutes, the United States surveyor-general "may appoint in each land district containing mineral lands as many competent surveyors as shall apply for appointment to survey mining claims."

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2. Capable persons desiring such appointments should therefore file their applications with the surveyor-general for the district wherein appointment is asked, who will furnish all information necessary.

3. Mineral surveyors may, at the same time, be appointed in more than one State or land district. (20 L. D., 163.)

4. The surveyors-general have authority to suspend or revoke the appointments of mineral surveyors for cause. The surveyors, however, will be allowed the right of appeal from the action of the surveyor-general in the usual manner. The appeal must be filed with the surveyor-general, who will at once transmit the same, with a full report, to the General Land Office. (20 L. D., 283.)

5. Neither the surveyor-general nor the Commissioner of the General Land Office has jurisdiction to settle differences, relative to the payment of charges for field work, between mineral surveyors and claimants. These are matters of private contract and must be enforced in the ordinary manner, i. e., in the local courts. The department has, however, authority to investigate charges affecting the official actions of mineral surveyors, including combinations to fix prices for survey work, and will, on sufficient cause shown, suspend or revoke the appointment of the surveyor.

6. Where error in the original survey appears to be the fault of the mineral surveyor who made the survey, he should be required to make the necessary corrections in the field as speedily as practicable; and upon his failure or refusal, without satisfactory reason, to comply with instructions within a specified time, he should be called upon to show why his appointment should not be suspended or revoked for willful neglect or incompetency. In the event he fails or refuses to comply with the instructions, the mineral claimant will be notified and given a reasonable time to apply for an amended survey.

7. These instructions are subject to the limitations of section 2324, United States Revised Statutes, so far as the same refers to local laws and customs.

8. The Commissioner of the General Land Office is ex-officio United States surveyor-general for Arkansas and Florida, and all surveys in Oklahoma are made under his direction as Commissioner.

BONDS.

9. All bonds of mineral surveyors must be submitted to the Commissioner of the General Land Office for approval.

10. The appointment of a mineral surveyor is not for any fixed period, the continuation thereof depending upon the character of the service rendered. The surveyor-general will, therefore, not appoint mineral surveyors for a specified term. While under the act of March 2, 1895 (28 Stat., 807), mineral surveyors' bonds are examined every two years as to their sufficiency, and new bonds required every four years from their dates, the latter requirement is not because the term has then expired.

11. A mineral surveyor is not authorized to perform any work under his appointment until his official bond shall have been accepted by the Commissioner of the General Land Office. The bond shall be in a sum not less than $5,000, and will become effective and the liability of the principal and surety will begin with the acceptance of the bond by the Commissioner.

12. Bonds can not be canceled, nor can the surety thereto withdraw, to the extent of relieving the surety of liability for defaults during the time the principal performed his duties thereunder. The most that may be done is to relieve the surety of future responsibility by requiring a new bond, or by the retirement from office of the principal, by formal notice from the Commissioner of the General Land Office.

13. Mineral surveyors' bonds will be examined every two years by the surveyor-general as to their sufficiency, and every four years such bonds shall be renewed as provided by the act of March 2, 1895 (28 Stat., 807). Only corporate sureties will be accepted.

14. If at any time the surveyor-general deems the surety on a bond insufficient, he will report the matter to the Commissioner of the General Land Office for instructions, notifying the mineral surveyor of his action, and the mineral surveyor will be required to renew his bond within sixty days under penalty of revocation of his appointment, unless satisfactory explanation of delay is offered therefor. Unsatisfactory service, also, will be deemed sufficient cause for a revocation

of an appointment, but the surveyor-general's action therein, subject to appeal, will require the approval of the Commissioner of the General Land Office.

15. The acceptance of a bond will be based upon an evident desirability or necessity therefor, and, prior to an acceptance of such bond, the principal will be required to make satisfactory explanation to the surveyor-general, supporting his tender of same.

INSTRUCTIONS TO MINERAL SURVEYORS.

GENERAL.

1. All official communications must be addressed to the *surveyor-general.*[a] You will always refer to the date and subject-matter of the letter to which you reply, and when a mineral claim is the subject of correspondence, you will give the name and survey number.

2. You should keep a complete record of each survey made by you, and of the facts coming to your knowledge at the time, as well as copies of all your field notes, reports, and official correspondence, in order that such evidence may be readily produced when called for at any future time.

3. Field notes and other reports must be written in a clear and legible hand or typewritten, in noncopying ink, and upon the proper blanks gratuitously furnished you by the surveyor-general's office upon application. *No interlineations or erasures* will be allowed, and no abbreviations or symbols must be used, except such as are indicated in the specimen field notes.

4. No return by you will be recognized as official unless it is over your signature as a United States mineral surveyor and made in pursuance of a special order from the surveyor-general's office. After you have received an order for survey, you are required to make the survey and return correct field notes thereof to the surveyor-general's office without delay.

5. The claimant is required, in all cases, to make satisfactory arrangements with you for the payment for your services and those of your assistants in making the survey, as the United States will not be held

[a] For list of offices of surveyors-general in mining districts, see page 2.

responsible for the same. You will call the attention of applicants for mineral-survey orders to the requirements of paragraph 12 of the circular, Appendix A. (Sec. 2334, U. S. Rev. Stats., par. 90, Mining Circular, May 21, 1907.)

6. You will promptly notify the surveyor-general's office of any change in your post-office address. (20 L. D., 163.)

7. You are precluded from acting, either directly or indirectly, as attorney in mineral claims. Your duty in any particular case ceases when you have executed the survey and returned the field notes and preliminary plat, with your report, to the surveyor-general. You will not be allowed to prepare for the mining claimant the papers in support of his application for patent, or otherwise perform the duties of an attorney before the land office in connection with a mining claim. You are not permitted to combine the duties of surveyor and notary public in the same case by administering oaths to the parties in interest. It is preferable that both preliminary and final oaths of assistants should be taken before some officer duly authorized to administer oaths, other than the mineral surveyor. In cases, however, where great delay, expense, or inconvenience would result from a strict compliance with this rule, you are authorized to administer the necessary oaths to your assistants, but in each case where this is done, you will submit to the proper surveyor-general a full written report of the circumstances which required your stated action; otherwise you must have absolutely nothing to do with the case, except in your official capacity as surveyor.

THE FIELD WORK.

8. The survey made and reported must, in every case, be an actual survey on the ground in full detail, made by you in person after the receipt of the order, and without reference to any knowledge you may have previously acquired by reason of having made the location survey or otherwise, and must show the actual facts existing at the time. This precludes you from calculating the connections to corners of the public survey and mineral monuments, or any other lines of your survey through prior surveys, unless it is satisfactorily shown in your report that you have retraced such lines and found them to be correct. (6 L. D., 718; 7 L. D., 81.)

The term *survey* in these instructions applies not only to the usual fieldwork, but also to the examinations required for the preparation of your affidavits of $500 expenditure, descriptive reports on placer claims, and all other reports.

SURVEY AND LOCATION.

9. The survey of a mining claim may include several contiguous locations owned in common, but such survey must, in conformity with statutory requirements, distinguish the several locations, and exhibit the boundaries of each. (5 L. D., 199; 6 L. D., 808; 29 L. D., 585.)

10. The survey must be made in strict conformity with, or be embraced within, the lines of the location upon which the order is based. If the survey and location are identical, that fact must be clearly and distinctly stated in your field notes. If not identical, a bearing and distance must be given from each established corner of the survey to the corresponding corner of the location, and the location corner must be fully described, so that it can be identified. The lines of the location, as found upon the ground, must be laid down upon the preliminary plat in such a manner as to contrast and show their relation to the lines of survey. (1 L. D., 581.)

The survey will be given but one number. A location under the mining laws can legally be made only of a tract or piece of land embraced within one set of boundary lines; and two or more tracts merely cornering with each other can not legally be embraced in a single location. (33 L. D., 560; 35 L. D., 485.)

11. In accordance with the principle that courses and distances must give way when in conflict with fixed objects and monuments, you will not under any circumstances change the corners of the location for the purpose of making them conform to the description in the record. If the difference from the location be slight, it may be explained in the field notes.

The act of Congress of May 10, 1872, expressly provides that "the location must be distinctly marked upon the ground so that its boundaries can be readily traced," and "that all records of mining claims hereafter made shall contain the name or names of the locators, the

date of the location, and such a description of the claim or claims located, by reference to some natural object or permanent monument, as will identify the claim." (Sec. 2324, U. S. Rev. Stats. See Appendix B herewith.)

These provisions of the law must be strictly complied with in each case to entitle the claimant to a survey and patent, and, therefore, should a claimant under a location made *subsequent* to the passage of the act of May 10, 1872, *who has not complied with said requirements in regard to marking the location upon the ground and recording the same, apply for a survey, you will decline to make it.* (1. L. D., 581.) You will then report the facts to the surveyor-general and await further instructions.

Should the survey be applied for under a location made prior to May 10, 1872, under section 2332, United States Revised Statutes, in making the survey thereof you will be governed by the special instructions accompanying the order for survey.

No mining claim located subsequent to May 10, 1872, should exceed the statutory limit in width on each side of the center of vein, or 1,500 feet in length, and all surveys must close within 50 to 100 feet in 1,000 feet, and the error must not be such as to make the location exceed the statutory limit; and in absence of other proof the discovery point is held to be the center of the vein on the surface. The course and length of the vein should be marked upon the plat and specifically described in the field notes.

LODE LINE AND END LINES.

It was held (syllabus) in 35 L. D., 22, that—

There is no warrant in the mining laws for extending, arbitrarily and without any basis of fact therefor, the vein or lode line of a location in an irregular and zigzag manner for the purpose of controlling the length or situation of the exterior lines of the location to suit the convenience, real or imagined, of the locator.

The end lines of a lode location must be straight and parallel to each other and when at right angles with the side lines may not exceed six hundred feet in length.

The mining laws contemplate that the end lines of a lode claim shall have substantial existence in fact, and in length shall reasonably comport with the width of the claim as located.

INSTRUMENT.

12. All mineral surveys must be made with a *transit*, either with or without a solar attachment, by which the meridian can be determined independently of the magnetic needle, and all courses must be referred to the true meridian. The variation should be noted at each corner of the survey.

THE TRUE MERIDIAN.

13. The true course of at least one line of each survey must be ascertained by astronomical observations, i. e., either Polaris or sun observations, made at the time of the survey; the data for determining the same and details as to how these data were arrived at must be given. Or, in lieu of the foregoing, the survey must be connected with some line the true course of which has been previously established beyond question, and in a similar manner by yourself, and, when such lines exist, it is desirable in all cases that they should be used as a proof of the accuracy of subsequent work. In this connection you will be governed by the instructions for methods of obtaining a true meridian. (Appendix B, p. 27.)

CONNECTIONS.

14. Connect corner No. 1 of each location embraced in your survey by course and distance with nearest corner of the public survey or with a United States mineral monument if the claim lies within 2 miles of such corner or monument. If both are within the required distance, you must connect with the nearest corner of the public survey. (7 L. D., 475; paragraph 36, Mining Circular, May 21, 1907.)

(*a*) You will make surveys and connections of mineral claims in suspended townships, so long as they remain suspended, in the same manner as though the claims were upon unsurveyed land, except as hereinbefore specified, by connecting them with independent mineral monuments. *At the same time you will note the position of any public land corner* which may be found in the neighborhood of the claim, so that, in case of the release of the township plat from suspension, the position of the claim can be shown on the plat.

(*b*) A mineral survey must not be returned with its connection made only with a corner of the public survey, where the survey of the township within which it is situated is under suspension, nor connected with a mineral monument alone when situated within the limits of a township or within 2 miles of a corner thereof the regularity and correctness of the survey of which is unquestioned.

If a mining claim is situated within the limits of a township, the regularity and correctness of the survey of which is unquestioned, but no corner of the public survey can be found within 2 miles of the claim after diligent search, connection may be made with a mineral monument, the mineral monument to be connected with a regularly established survey corner.

(*c*) In making an official survey hereafter you will establish corner No. 1 of each location embraced in your survey at the corner nearest the corner of the public survey or mineral monument, unless good cause is shown for its being placed otherwise. If connections are given to both a corner of the public survey and mineral monument, corners Nos. 1 should be placed at the end nearest the corner of the public survey.

15. When a boundary line of a *mineral* claim intersects a section line, give courses and distances from the points of intersection to the corners of the public surveys at each end of the half mile of section line so intersected.

MINERAL MONUMENTS.

16. In case your survey is situated in a district where there are no corners of the public survey and no monuments within the prescribed limits, you will proceed to establish a mineral monument, in the location of which you will exercise the greatest care to insure permanency as to site and construction.

The site, when practicable, should be some prominent point, visible for a long distance from every direction, and should be so chosen that the permanency of the monument will not be endangered by snow, rock or landslides, or other natural causes. Its position with reference to latitude and longitude should be determined and stated as accurately as the instruments used will permit.

17. The monument should consist of a stone not less than 30 inches long, 20 inches wide, and 6 inches thick, set halfway in the ground, with a conical mound of stone 4 feet high and 6 feet base alongside. The letters U.S.M.M., followed by the consecutive number of the monument in the district, must be plainly chiseled upon the stone. If impracticable to obtain a stone of required dimensions, then a post 8 feet long, 6 inches square, set 3 feet in the ground, scribed as for a stone monument, protected by a well-built conical mound of stone of not less than 3 feet high and 6 feet base around it, may be used. The exact point for connection must be indicated on the monument by a + chiseled thereon; if a post is used, then a tack must be driven into the post to indicate the point. Any necessary departure from the prescribed material and size of monument must be fully explained.

18. From the monument connections by course and distance must be taken to two or three bearing trees or rocks, and to any well-known and permanent objects in the vicinity, such as the confluence of streams, prominent rocks, buildings, shafts, or mouths of adits. Bearing trees must be properly scribed B T and bearing rocks chiseled B R together with the number of the mineral monument; the exact point on the tree or stone to which the connection is taken should be indicated by a cross or other unmistakable mark. Bearings should also be taken to prominent mountain peaks, and the approximate distance and direction ascertained from the nearest town or mining camp. A detailed description of the mineral monument, with a topographical map of its location, should be furnished the General Land Office.

Where practicable, it is desired that mineral surveyors connect by course and distance with mineral monuments in the vicinity other than those prescribed for connections as being within the limitation of distance. The purpose of this is to enable the General Land Office to locate the various mineral monuments established and used prior to the extension of the public subdivisional surveys over the land.

CORNERS.

19. Corners may consist of—

(1) A stone at least 24 inches long set 12 inches in the ground, with a conical mound of stone 1½ feet high, 2 feet base, alongside, and state

kind of stone set for corner. A stone should always be used for a corner when possible.

(2) A post at least 3 feet long by 4 inches square, set 18 inches in the ground and surrounded by a substantial mound of stone or earth.

(3) A rock in place.

Should it become necessary to vary from these instructions, your returns must contain a full statement of the reason for establishing a corner differing from those prescribed.

20. All corners must be established in a permanent and workmanlike manner, and the corner and survey number must be neatly chiseled or scribed on the sides facing the claim. The *exact* corner point must be permanently indicated on the corner. When a rock in place is used its dimensions above ground must be stated, and a cross chiseled at the exact corner point.

21. In case the point for the corner be inaccessible or unsuitable, you will establish a witness corner, which must be marked with the letters W C in addition to the corner and survey number. The witness corner should be located upon a line of the survey and as near as possible to the true corner with which it must be connected by course and distance. The reason why it is impossible or impracticable to establish the true corner must always be stated in the field notes, and in running your next course state whether you start from the true place for corner or from witness corner.

22. The identity of all corners should be perpetuated by taking courses and distances to bearing trees, rocks, and other objects, as prescribed in the establishment of mineral monuments, and when no bearings are given, state "no bearings available." Permanent objects should be selected for bearings whenever possible.

23. If an official mineral survey has been made in the vicinity, within a reasonable distance, a further connecting line should be run to some corner thereof; and in like manner all conflicting surveys and locations should be so connected, and the corner with which connection is made in each case described. Such connections will be made and conflicts shown according to the boundaries of the neighboring or conflicting claims as each is marked, defined, and actually established

upon the ground. You will fully and specifically state in your returns *how* and by what *visible evidences* you were able to identify on the ground the several conflicting surveys and those which appear according to their returned tie or boundary lines to conflict, if they were so identified, and report errors or discrepancies found by you in any such surveys. In the survey of contiguous claims which constitute a consolidated group, where corners are common, bearings should be mentioned but once.

Tubular iron posts with flaring base, cement core, and brass cap for marking with steel stamps, have been adopted for agricultural public-land-survey corners, and it is believed that, wherever possible, the establishment of similar corners for mineral surveys would add greatly to the value of the survey made. Such corners are identified at a glance, may be accurately set, are difficult to move, easily found, and are indestructible. Their use is recommended.

TOPOGRAPHY.

24. Note carefully all topographical features of the claim, taking distances on your lines to intersections with all streams, gulches, ditches, ravines, mountain ridges, roads, trails, etc., with their widths, courses, and other data that may be required to map them correctly. If the claim lies within a townsite, locate all municipal improvements, such as blocks, streets and buildings.

CONFLICTS.

25. If, in running the exterior lines of a claim, the survey is found to conflict with the survey of another claim, the distances to the points of intersection, and the courses and distances along the line intersected from an established corner of such conflicting claim to such points of intersection, should be described in the field notes: *Provided*, That where a corner of the conflicting survey falls within the claim being surveyed, such corner should be selected from which to give the bearing, otherwise the corner nearest the intersection should be taken. The same rule should govern in the survey of claims embracing two or more locations the lines of which intersect.

LODE AND MILL SITE.

26. A lode and mill-site claim in one survey will be distinguished by the letters A and B following the number of the survey. The corners of the mill site will be numbered independently of those of the lode. Corner No. 1 of the mill site must be connected with a corner of the lode claim as well as with a corner of the public survey or mineral monument.

FIELD NOTES.

27. In order that the results of your survey may be reported in a uniform manner, you will prepare your field notes and preliminary plat in strict conformity with the specimen field notes and plats, which are made part of these instructions. They are designed to furnish you all the needed information concerning the manner of describing the boundaries, corners, connections, intersections, conflicts, and improvements, and stating the variation, area, location, and other data connected with the survey of mineral claims, and certain forms of affidavits for the surveyor and his assistants.

28. When a placer claim includes lodes, or when several contiguous placer or lode locations are included as one claim in one survey, you will give to the corners of each location constituting the same a separate consecutive numerical designation, beginning with corner No. 1 in each case. In the former case, you will first describe the placer claim in your field notes.

29. Throughout the description of the survey, after each reference to the lines or corners of a location, give the name thereof, and if unsurveyed state the fact. If reference is made to a location included in a prior official survey, the survey number must be given, followed by the name of the location. Describe your corners once only.

30. The total area of each location in a group embraced by its exterior boundaries, and also the area in conflict with each intersecting survey or claim, should be stated. The area claimed will not be stated. But when locations of the survey conflict with each other such conflicts should only be stated in connection with the location from which the conflicting area is excluded.

The field notes and plat of survey should not show *exclusions*, attempt to specify the *net area* of the claim. These are matters for t applicant to state in connection with his application for patent, and t notices posted and published. The field notes should merely sh the total and net areas of conflict, so that any exclusion desired may readily made.

31. You will state particularly whether the claim is upon survey or unsurveyed public lands, giving in the former case the quarter s tion, township, and range in which it is located, and in the latter, t township and range as near as can be determined. When upon s veyed lands the section lines should be indicated by full lines and t quarter-section lines by dotted lines.

32. The title page must contain the post-office address of the claima or his authorized agent.

EXPENDITURE OF $500.

33. In making out your certificate of the value of the improvemen you will follow the form prescribed in the specimen field notes.

34. Only *actual* expenditures and *mining* improvements made by t claimant or his grantors, having a direct relation to the development the claim, can be included in your estimate. "Labor or improvemen within the meaning of the statute, are deemed to have been had on mining claim, whether it consists of one location or several, when t labor is performed or the improvements are made for its developme that is, to facilitate the extraction of the metals it may contain (6 L. D., 222.)

35. The expenditures required may be made from the surface or running a tunnel, drifts, or crosscuts, for the development of the clai Improvements of any other character, such as buildings, machinery, roadways, must be excluded from your estimate unless you show clea that they are associated with actual excavations, such as cuts, tunne shafts, etc., are essential to the practical development of, and actua facilitate the extraction of mineral from the claim.

36. You will locate all mining and other improvements upon t claim by courses and distances from corners of the survey, or fr

points on the indicated lode line, or side lines, specifying with particularity and detail the dimensions and character of each, and the improvements upon each location should be numbered consecutively, the point of discovery being always No. 1. Improvements made by a former locator, who has abandoned his claim, can not be included in the estimate, but should be described and located by separate statement, in the notes and on the plat.

37. You will give in detail the *value* of each mining improvement included in your estimate of expenditures, and when a tunnel or other improvement has been made for the development of other claims in connection with the one for which survey is made, you must give the name, ownership, and survey number, if any, of each claim to be credited, and the value of the interest credited to each claim.

38. In case of a lode and mill site in the same survey, an expenditure of $500 is required to be shown upon the lode claim only.

COMMON IMPROVEMENTS, ETC.

39. When a survey embraces several locations held in common constituting one entire claim whether lode or placer, an expenditure of $500 for each location embraced in the survey will be sufficient.

It was held (syllabus) in 35 L. D., 361, that—

Where several contiguous mining claims are held in common and expenditures are made upon an improvement intended to aid in the common development of all of the claims so held, and which is of such character as to redound to the benefit of all, such improvement is properly called a common improvement.

Each of a group of contiguous mining claims held in common and developed by a common improvement has an equal, undivided interest in such improvement, which is to be determined by a calculation based upon the number of claims in the group and the value of the common improvement.

There is no authority in the law for an unequal assignment of credits out of the cost of an improvement made for the common benefit of a number of mining claims, or the apportionment of a physical segment of an improvement of that character to any particular claim or claims of the number, such an arbitrary judgment of credits, as the exigencies of the case may seem to require, being utterly at variance with the essential idea inherent in the term, a common improvement.

In any patent proceedings where a part of a group of mining claims is applied for and reliance is had upon a common improvement, the land department should be fully advised as to the total number of claims embraced in the group, as to their ownership,

and as to their relative situations, properly delineated upon an authenticated map or diagram. Such information should always be furnished in connection with the first proceeding involving an application of credit from the common improvement, and should be referred to and properly supplemented in each subsequent patent application in which a like credit is sought to be applied.

IMPROVEMENTS SUCCEED LOCATIONS, ETC.

It was also held (syllabus) in 36 L. D., 551, that—

A common improvement or system, offered for patent purposes, although of sufficient aggregate value and of the requisite benefit to all the mining claims of a group, can not be accepted as it then stands in full satisfaction of the statutory requirement as to such of the claims the location of which it preceded, the law requiring that an expenditure of at least $500 shall *succeed* the location of every claim.

If the requisite benefit to the group is shown, or to the extent of such of the claims as are so benefited, and the elements of contiguity and common interest in the claims concerned appear; if the improvement represents a total value sufficient for patent purposes for the number of claims so involved; if for each claim located after the partial construction of the improvement the latter has been subsequently extended so as to represent an added value of not less than $500, each is entitled under the law to a share of the value of the common improvement in its entirety, no claim receiving more or less than another from that source, participating therein without distinction or difference, and as to each the statutory requirement is satisfied.

40. The explanatory statement in such cases should be given in your field notes, or affidavit, at the conclusion of the description of the improvements included in the estimate of expenditure, and should be as full and explicit as the facts in the case warrant, dealing only with the improvements, conditions, and circumstances as they actually existed at the time of making the survey or examination.

41. If the value of the labor and improvements upon a mineral claim is less than $500 at the time of survey, you are authorized to file thereafter supplemental proof, showing $500 expenditure made prior to the expiration of the period of publication. The information on which to base this proof must be derived by the surveyor, who makes the actual survey, from a careful examination upon the premises.

42. You will file with your field notes a preliminary plat made on tracing cloth, protracted on a scale of 200 feet to an inch, if practicable, in conformity with the specimen plat herewith. In preparing plats make the top north. Copy of your calculations of areas by double

meridian distances and of all triangulations or traverse lines must also be furnished. The lines of the claim surveyed, on this plat and on all plats of *approved* surveys, should be heavier and show a contrast with conflicting claims.

ERRORS.

43. Where error in an original survey appears prior to the issuance of patent, the surveyor, who made such survey, will be required to make the necessary corrections in the field within a specified time; and failure or refusal, without satisfactory reason therefor, to comply with instructions will be followed by suspension or revocation of appointment. The mineral claimant will be notified of the action taken and given a reasonable time to apply for an amended survey.

Whenever a survey is reported in error by a surveyor, the surveyor who made the survey will be required promptly to examine same upon the ground, and, if found in error, will report the errors in detail, under oath, to the surveyor-general's office. If he should report his survey correct, a joint survey with the surveyor who reported the errors will be ordered to settle the differences.

JOINT SURVEY.

44. A joint survey must be made within ten days after the date of order, unless satisfactory reasons are submitted, under oath, for a postponement.

45. The fieldwork must in every sense of the term be a *joint* and not a separate survey, and the observations and measurements taken with the same instrument and chain, previously tested and agreed upon.

46. The surveyor found in error, will make out the field notes of the joint survey, which, after being duly signed and sworn to by both parties, must be transmitted to the surveyor-general's office.

AMENDED SURVEYS.

47. Inasmuch as amended surveys are ordered only by special instructions from the General Land Office, and the conditions and circumstances peculiar to each separate case, and the object sought by the required amendment, alone govern all special matters relative to the

manner of making such survey and the form and subject-matter to be embraced in the field notes thereof, but few general rules applicable to all cases can be laid down.

48. The amended survey must be made in strict conformity with, or be embraced within, the lines of the original survey. If the amended and original surveys are identical, that fact must be clearly and distinctly stated in your field notes. If not identical, a bearing and distance must be given from each established corner of the amended survey to the corresponding corner of the original survey. The lines of the original survey, as found upon the ground, must be laid down upon the preliminary plat in such manner as to contrast and show their relation to the lines of the amended survey.

49. The field notes of the amended survey must be prepared on the same size and form of blanks as are the field notes of the original survey, and the word "amended" must be used before the word "survey" wherever it occurs in the field notes.

DESCRIPTIVE REPORTS ON PLACER CLAIMS.

50. By General Land Office circular, approved May 21, 1907, paragraph 60, you are required to make a full examination of all placer claims at the time of survey, and file with your field notes a descriptive report, in which you will describe:

(*a*) The quality and composition of the soil, and the kind and amount of timber, and other vegetation.

(*b*) The location and size of streams, and such other matter as may appear upon the surface of the claims.

(*c*) The character and extent of all surface and underground workings, whether placer or lode, for mining purposes, locating and describing them.

(*d*) The proximity of centers of trade or residence.

(*e*) The proximity of well-known systems of lode deposits or of individual lodes.

(*f*) The use or adaptability of the claim for placer mining, and whether water has been brought upon it in sufficient quantity to mine the same, or whether it can be procured for that purpose.

(*g*) What works or expenditures have been made by the claimant or his grantors for the development of the claim, and their situation and location with respect to the same as applied for.

(*h*) The true situation of all mines, salt licks, salt springs, and mill-seats, which come to your knowledge, or report that none exist on the claim, as the facts may warrant.

(*i*) Said report must be made under oath, and duly corroborated by one or more disinterested persons.

51. Descriptive reports, as above, on placer claims taken by legal subdivisions will not be made, as mineral surveyors have no duties to perform touching such claims. (Sec. 2331, U. S. Rev. Stats., and paragraph 58, Mining Circular, approved May 21, 1907.)

PRACTICE.

52. Claimants, their attorneys, or parties in interest shall not be employed as assistants in making mineral surveys.

53. Your fieldwork must be accurately and properly performed and your returns made in conformity with the foregoing instructions. Errors in the survey must be corrcted at your own expense, and if the time required in the examination of your returns is increased by reason of your neglect or carelessness, you will be required to make an additional deposit for office work. You will be held to a strict accountability for the faithful discharge of your duties, and will be required to observe fully the requirements and regulations in force as to making mineral surveys. If found incompetent as a surveyor, careless in the discharge of your duties, or guilty of a violation of said regulations, your appointment will be promptly revoked.

A mineral surveyor is within the purview of section 452 of the Revised Statutes, which prohibits officers, clerks, and employees in the General Land Office from directly or indirectly purchasing or becoming interested in the purchase of any of the public lands, upon penalty of forfeiture of his official position. (36 L. D., 61.)

APPENDIX A.

CIRCULAR TO APPLICANTS.

Applicants for mineral survey orders will observe the following requirements in the conduct of their business with the surveyor-general's office, the same being based upon the United States mining laws, and circular and special instructions from the Commissioner of the General Land Office:

1. All applications for survey orders, descriptive reports on placer claims, or certificates of $500 expenditures, should be addressed to the surveyor-general,[a] and be signed by the claimants, their agents or attorney.

2. Each application should contain:

(*a*) The name of the claimant in full, and as it is desired to appear in the application for patent.

(*b*) The name of each location embraced in the claim.

(*c*) The name of the land and mining districts in which the claim is located.

(*d*) The name of the mineral surveyor to whom it is desired the order shall be issued.

(For form of application see page 58.)

3. The applicant is required to file with each application for survey order a copy of the record of location of the claim, properly certified by the recorder of the county or mining district where the claim is situate.

[a] See page 2 for list of offices of United States surveyors-general.

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4. The mineral surveyor is required to survey the claim in *strict conformity* with or *within* the lines of the location upon which the order of survey is based. The applicant is therefore advised, before filing his application, to see that his location has been made in compliance with the law and regulations, and that it properly describes the claim for which patent is to be sought.

Section 2324, United States Revised Statutes, expressly provides that "the location must be distinctly marked on the ground so that its boundaries can be readily traced," and that "all records of mining claims hereafter made shall contain the name or names of the locators, the date of the location, and such a description of the claim or claims located by reference to some natural object or permanent monument as will identify the claim."

These provisions of the law must be strictly complied with in each case, to entitle a claimant to a survey and patent, and therefore should a claimant under a location made *subsequent* to the passage of the mining act of May 10, 1872 (referred to in said section 2324), who has not complied with said requirements in regard to marking the location upon the ground, and recording the same, apply for a survey, the surveyor-general will decline to order it.

The only relief for a party under such circumstances will be to make a new location in conformity to law and regulations, as no survey will be approved by the surveyor-general's office, unless these and all other provisions of law are substantially complied with.

A lode locator may not, in the same location, lawfully include any surface area, or acquire any incidental mining rights therein, outside of the course of, or vertical planes drawn downward through, the established end lines of his claim extended in their own direction. (35 L. D., 592.)

5. The surveyor-general will furnish the applicant an estimate of the cost of the *platting* and other *office work* connected with the survey in his office, which amount the applicant will deposit with any assistant United States treasurer, or designated depository, in favor of the United States Treasurer, to be passed to the credit of the fund created

by "individual depositors for surveys of the public lands." The duplicate certificate issued for such deposit will be immediately forwarded to the office of the surveyor-general by the applicant who will retain the triplicate certificate for his own use and security. Under no circumstances can this deposit be made with or by the surveyor-general.

Payment for *exemplified copies* of plats or other records in the office of the surveyor-general will be made or remitted directly to that officer, who will promptly receipt for the same. (36 L. D., 125.)

6. The various surveyors-general have schedules of rates for office work, and an estimate of the cost in any particular case may be had upon application.

Should an applicant deem an estimate excessive, he will be allowed the right of appeal to the General Land Office in the usual manner.

In transmitting such an appeal the surveyor-general should transmit therewith a full report.

7. An application for an amended survey order must be accompanied with a statement setting forth fully the reasons for the proposed amendment and all the material facts in the matter.

8. If, after having obtained a survey order, the applicant should abandon his purpose of having a survey made, he can apply the deposit, less the amount estimated for office expenses already incurred, on a survey *of another claim* if one is desired.

9. Upon discovery of any error or defect in an order the applicant is requested to return it to the surveyor-general's office for correction or amendment.

10. If, after having obtained an order for survey, the applicant should find that the record of location does not practically describe the location as staked upon the ground, he should file a certified copy of an amended location certificate, correctly describing the claim, and obtain an *amended order* for survey.

11. The order of approval of surveys of mineral claims is prescribed by General Land Office circular dated March 3, 1881, as follows:

The mining survey first applied for shall have the priority of action in all its stages in the office of the surveyor-general including the deliv-

ery thereof, over any other survey of the same ground or any portion thereof.

The surveyor-general should not order or authorize a survey of a claim which conflicts with one previously applied for until the survey first applied for has been completed, examined, approved, and platted, and the plats delivered, unless the survey first authorized is not returned within a reasonable period, and the applicant for a conflicting survey makes affidavit that he believes (stating the reasons for his belief) that such first applicant has abandoned his purpose of having a survey made, or is deferring it for vexatious purposes, to wit, to postpone the subsequent applicant, in which case the surveyor-general shall give notice of such charges to such first applicant, and call upon him for an explanation under oath of the delay. He shall also require the mineral surveyor to make a full statement in writing, explanatory of the delay; and if the surveyor-general shall conclude that good and sufficient reasons for such delay do not exist, he shall authorize the applicant for the conflicting survey to proceed with the same; otherwise the order of proceedings shall not be changed.

When the conflict does not appear until the field notes of the respective surveys are returned, then the survey first applied for should be first examined, approved, and platted, and the plats delivered before the field notes of the survey last applied for are taken up for examination or plats constructed.

Whenever an applicant for a survey shall have reason to suppose that a conflicting claimant will also apply for a survey for patent, he may give a notice in writing to the surveyor-general particularly describing such conflicting claim, and file a copy of the notice of location of such conflicting claim. In such case the surveyor-general will not order or authorize any survey of such conflicting claim until the survey first applied for has been examined, completed, approved, and platted, and the plats delivered.

12. The applicant has the option of employing any United States mineral surveyor in the district to execute the order of survey, and must make satisfactory arrangements with such surveyor for the pay-

ment of his services and those of his assistants in making the survey, as the United States will not be held responsible for the payment of the same. The duty of the surveyor in any particular case ceases when he has executed the survey and filed his returns of survey in the surveyor-general's office. He is not allowed to prepare for the mining claimant the papers in support of an application for patent, being precluded from acting either directly or indirectly as attorney in mineral claims. (Sec. 2334, U. S. Rev. Stats.)

13. The applicant is advised of his right to appeal to the Commissioner of the General Land Office from the approval or disapproval of the survey of his claim. The appeal must be in writing or in print, should set forth in brief and clear terms the specific points of exception to the ruling appealed from, and should be transmitted through the surveyor-general's office.

APPENDIX B.

EXTRACT FROM "MANUAL OF SURVEYING INSTRUCTIONS FOR THE SURVEY OF THE PUBLIC LANDS OF THE UNITED STATES AND PRIVATE LAND CLAIMS." (1902), PAGES 91-110, INCLUSIVE.

* * * * * * *

METHODS OF OBTAINING A TRUE MERIDIAN.

293. The work of every deputy surveyor or examiner depends for its correctness upon his using a correct meridian, which can be obtained only by careful observance of the following instructions. They include astronomical tables, adapted from data heretofore supplied by the Coast and Geodetic Survey, and brought down to dates in the twentieth century.

The accuracy with which the meridian may be determined depends chiefly upon the instruments at command and upon the ability and care of the observer in using them. It rests with him to select the proper instrument, the proper method, and time for observing. The instruments ordinarily in the hands of the surveyor are sufficiently described in books on surveying or in catalogues of instrument makers. The method to be followed will depend greatly upon circumstances. Thus the sun or the pole star may be observed for azimuth; local time may be had by the method of equal altitudes of the sun, for which the latitude of the place need only to be known roughly. Observations of the pole star for the true azimuth are generally preferred, since no great precision in the local time is required. Tables and explanatory remarks have been inserted to facilitate the use of this method, and will serve for the period 1901 to 1910.

294. The table given in the Manual of 1894 for times of elongation and culmination at 24 dates of the year 1893, with a system of corrections for other years and dates, is now omitted. All the necessary data therein given can now be obtained from the upper culmination table on page 101 in the form already familiar but revised and extended for the present decade.

295. For correct and rapid use of these tables, it is indispensable that the surveyor have clear comprehension of the outlines of the astronomical facts involved, and the terms used in dealing with them, such as the following:

The earth's annual motion around the sun.

Its diurnal motion upon its axis.

The apparent opposite motion of Polaris and other circumpolar stars about the north-polar point in the heavens. (See figure 1 on page 97.) [Page 37 hereof.]

Mean solar time, derived from successive apparent passages of the sun across the local meridian, and averaged or equalized for the year to remove irregularities caused by the earth's varying distances from the sun, often shown in almanacs under the head, "sun fast" or "sun slow."

Equation of time, as tabulated in the ephemeris.

Sidereal time, measured by the astronomical day of 23 hrs. 56.1 min., the interval between two successive passages of a fixed star across the local meridian.

The civil day, beginning at midnight, and its relation to the astronomical day, which begins at noon. The former counts twelve hours twice over, the latter numbers the hours up to 24, and lasts twelve hours after the civil day of the same date is ended.

The culminations of Polaris.

The elongations of Polaris.

The azimuth of Polaris or its apparent distance east or west from the polar point, measured by a horizontal angle at the place of observation.

The hour-angle azimuth of Polaris at those times when it is neither at elongation nor culmination.

The meridian of any locality. Since any line not coinciding with the true meridian is not a meridian, the use of the word true is superfluous and generally avoided.

Reduction of standard time to local mean time by difference of longitude.

296. These essentials are presumed to have been acquired in preparatory studies; therefore it is the purpose of the Manual to simplify the work, omit all technicalities requiring a full knowledge of astronomy, and present the method, with two new and compact tables adapted to common clock time, with such plain directions for use that any person of ordinary intelligence can understand and apply them.

297. As the surveyor should have a perfectly clear idea of what is meant by astronomical time (used to simplify computations), and the hour angle of Polaris, these terms will now be explained.

298. The Civil Day, according to the customs of society, commences at midnight and comprises twenty-four hours from one midnight to the next following. The hours are counted from 12 to 12 from midnight to noon, after which they are again reckoned from 12 to 12 from noon to midnight. Thus the day is divided into two periods of 12 hours each, the first of which is marked a. m., the last p. m.

299. The Astronomical Day commences at noon on the civil day of the same date. It also comprises twenty-four hours; but they are reckoned from 0 to 24, and from the noon of one day to that of the next following.

The civil day begins twelve hours before the astronomical day; therefore the first period of the civil day answers to the last part of the preceding astronomical day, and the last part of the civil day corresponds to the first part of the astronomical day. Thus, January 9, 2 o'clock p. m., civil time, is also January 9, 2^h, astronomical time; and January 9, 2 o'clock a. m., civil time, is January 8, 14^h, astronomical time.

300. The rule then for the transformation of civil time into astronomical time is this: *If the civil time is marked p. m., take away the*

designation p. m., and the astronomical time is had without further change; if the civil time is marked a. m., take one from the day and add twelve to the hours, remove the initials a. m., and the result is the astronomical time wanted.

The substance of the above rule may be otherwise stated, as follows: When the surveyor takes an observation during p. m. hours, civil time, he can say: the astronomical time is the hours and minutes passed since the noon of this day; and when observing in the a. m. hours he can say the astronomical time is the hours and minutes elapsed since the noon of yesterday, in either case omitting the designation a. m. or p. m., and writing for the day of the month, that civil date on which the noon falls, from which the time is reckoned. Finally, *the astronomical time may be called the hours and minutes elapsed since the noon last past, the astronomical date being that of the civil day to which the noon belongs.* Thus, April 23, 4.15 p. m., civil time, is April 23, 4^h 15^m, astronomical time, and April 23, 4.15 a. m., civil time, is April 22, 16^h 15^m, astronomical time.

The surveyor should thoroughly master this transformation of the civil time into astronomical time, as it will be the first duty he will have to perform after observing Polaris out of the meridian.

The change can be made mentally, no written work being required. Table V might be easily altered to give the times by the civil count marked a. m. and p. m., but such an arrangement would greatly extend and complicate the rules and examples, and correspondingly increase the chances for error.

301. The general use of telescopic instruments makes it far easier to determine a meridian than formerly when the open-sight compass was almost the only obtainable instrument. In those days it was required that the deputy ascertain for himself by observation what was the true north line, and then observe and record the "variation" of his needle from the north. Instructions for the process have been an important part of the early manuals, and surveyors of integrity faithfully observed them. Similar directions are here given.

TO DETERMINE A MERIDIAN WITHOUT A TELESCOPE.

302. Attach a plumb line to a support situated as far above the ground as practicable, such as the limb of a tree, a piece of board nailed or otherwise fastened to a telegraph pole, a house, barn, or other building, affording a clear view north and south.

The plumb bob may consist of some weighty material, such as a brick, a piece of iron or stone, weighing four to five pounds, which will hold the plumb line vertical, fully as well as one of finished metal.

Strongly illuminate the plumb line just below its support by a lamp or candle, care being taken to obscure the source of light from the view of the observer by a screen.

For a peep sight, cut a slot about one-sixteenth of an inch wide in a thin piece of board, or nail two strips of tin, with straight edges, to a square block of wood, so arranged that they will stand vertical when the block is placed flat on its base upon a smooth horizontal rest, which will be placed at a convenient height south of the plumb line and firmly secured in an east and west direction, in such a position that, when viewed through the peep sight, Polaris will appear about a foot below the support of the plumb line.

The position may be practically determined by trial the night preceding that set for the observation.

About thirty minutes before the time of elongation, as obtained from the table, bring the peep sight into the same line of sight with the plumb line and Polaris.

To reach elongation, the star will move off the plumb line to the east for eastern elongation, or to the west for western elongation, therefore by moving the peep sight in the proper direction, east or west, as the case may be, keep the star on the plumb line until it appears to remain stationary, thus indicating that it has reached its point of elongation.

The peep sight will now be secured in place by a clamp or weight, with its exact position marked on the rest, and all further operations will be deferred until the next morning.

By daylight place a slender rod at a distance of two or three hundred feet from the peep sight and exactly in range with it and the plumb line; carefully measure this distance.

Take from the table on page 95 [page 34 hereof] the azimuth of Polaris corresponding to the latitude of the station and year of observation; find the natural tangent of said azimuth and multiply it by the distance from the peep sight to the rod; the product will express the distance to be laid off from the rod exactly at right angles to the direction already determined (to the west for eastern elongation or to the east for western elongation) to a point, which with the peep sight, will define the direction of the meridian with sufficient accuracy for the needs of local surveyors.

TO ESTABLISH A MERIDIAN AT ELONGATION BY TELESCOPIC INSTRUMENT.

303. Set a stone or drive a wooden peg firmly in the ground, and upon the top thereof make a small distinct mark.

About thirty minutes before the time of the eastern or western elongation of Polaris, obtained from the table, set up the transit firmly, with its vertical axis exactly over the mark, and carefully level the instrument.

Illuminate the cross wires by the light from a suitable lantern, the rays being directed into the object end of the telescope by an assistant; while great care will be taken, by perfect leveling, to insure that the line of collimation describes a truly vertical plane.

Place the vertical wire upon the star, which, if it has not reached its elongation, will move to the right for eastern, or to the left for western elongation.

While the star moves toward its point of elongation, by means of the tangent screw of the vernier plate it will be repeatedly covered by the vertical wire, until a point is reached where it will appear to remain on the wire for some time, then leave it in a direction contrary to its former motion; thus indicating the time of elongation.

Then, while the star appears to thread the vertical wire, depress the telescope to a horizontal position; five chains north of the place of observation, set a stone or drive a firm peg, upon which by a strongly illumi-

nated pencil or other slender object, exactly coincident with the vertical wire, mark a point and drive a tack in the line of sight thus determined; then, to eliminate possible errors of collimation or imperfect verticality of the motion of the telescope, quickly revolve the vernier plate 180°, direct the glass at Polaris and repeat the observation; if it gives a different result, find and mark the middle point between the two results. This middle point, with the point marked by the plumb bob of the transit, will define on the ground the trace of the vertical plane through Polaris at its eastern or western elongation, as the case may be.

By daylight, lay off to the east or west, as the case may require, the proper azimuth taken from the following table; the instrument will then define the meridian, which may be permanently marked for future reference.

The magnetic declination may be obtained from a true meridian, as follows: Take the magnetic bearing of the true meridian; then the angle expressed by said magnetic bearing will be the observed magnetic declination, named like the departure if the bearing is taken from the south needle-point, but the reverse if from the north.

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TABLE IV.—*Azimuths of Polaris when at elongation for any year from 1900 to 1910, inclusive, and for any latitude from 25° to 72° north.*

Latitude.	1900.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.
°	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′	° ′
25	1 21.2	1 20.8	1 20.5	1 20.1	1 19.8	1 19.4	1 19.1	1 18.7	1 18.4	1 18.1	1 17.7
26	21.8	21.5	21.1	20.8	20.5	20.1	19.8	19.4	19.1	18.7	18.4
27	22.5	22.2	21.9	21.5	21.2	20.8	20.5	20.1	19.8	19.4	19.1
28	23.3	23.0	22.6	22.2	21.9	21.6	21.3	20.9	20.5	20.1	19.8
29	24.1	23.8	23.4	23.0	22.7	22.4	22.1	21.7	21.3	20.9	20.5
30	1 24.9	1 24.6	1 24.2	1 23.9	1 23.5	1 23.1	1 22.8	1 22.4	1 22.1	1 21.7	1 21.3
31	25.8	25.5	25.1	24.7	24.4	24.0	23.6	23.2	22.9	22.5	22.2
32	26.7	26.4	26.0	25.6	25.3	24.9	24.5	24.1	23.8	23.4	23.1
33	27.7	27.3	27.0	26.6	26.2	25.9	25.5	25.1	24.7	24.3	24.0
34	28.7	28.4	28.0	27.6	27.2	26.9	26.5	26.1	25.7	25.3	25.0
35	1 29.8	1 29.4	1 29.0	1 28.7	1 28.3	1 27.9	1 27.5	1 27.1	1 26.8	1 26.4	1 26.0
36	30.9	30.5	30.1	29.8	29.4	29.0	28.6	28.2	27.9	27.5	27.1
37	32.1	31.7	31.3	30.9	30.5	30.1	29.7	29.3	29.0	28.6	28.2
38	33.4	33.0	32.6	32.2	31.8	31.4	31.0	30.6	30.2	29.8	29.4
39	34.7	34.3	33.9	33.5	33.1	32.7	32.3	31.8	31.4	31.0	30.6
40	1 36.0	1 35.6	1 35.2	1 34.8	1 34.4	1 34.0	1 33.6	1 33.2	1 32.8	1 32.4	1 32.0
41	37.5	37.1	36.7	36.2	35.8	35.4	35.0	34.6	34.2	33.8	33.4
42	39.0	38.6	38.2	37.7	37.3	36.9	36.5	36.0	35.6	35.2	34.8
43	40.6	40.2	39.8	39.3	38.9	38.5	38.1	37.6	37.2	36.8	36.3
44	42.3	41.8	41.4	41.0	40.5	40.1	39.7	39.2	38.8	38.4	37.9
45	1 44.0	1 43.6	1 43.2	1 42.7	1 42.3	1 41.8	1 41.4	1 40.9	1 40.5	1 40.1	1 39.6
46	45.9	45.5	45.0	44.6	44.2	43.7	43.2	42.7	42.3	41.9	41.4
47	47.9	47.4	46.9	46.5	46.0	45.6	45.1	44.6	44.2	43.7	43.3
48	49.9	49.5	49.0	48.6	48.1	47.7	47.2	46.7	46.3	45.8	45.3
49	52.1	51.7	51.2	50.7	50.2	49.8	49.3	48.8	48.4	47.9	47.4
50	1 54.4	1 54.0	1 53.5	1 53.0	1 52.5	1 52.0	1 51.5	1 51.0	1 50.6	1 50.1	1 49.6
51	56.9	56.4	55.9	55.4	54.9	54.4	54.0	53.5	53.0	52.5	52.0
52	59.5	59.0	58.5	58.0	57.5	57.0	56.4	55.9	55.4	54.9	54.4
53	2 02.2	2 01.7	2 01.2	2 00.7	2 00.2	59.6	59.1	58.6	58.1	57.6	57.1
54	05.1	04.6	04.1	03.5	03.0	2 02.5	2 02.0	2 01.5	2 00.9	2 00.4	59.9

55	2 08.3	2 07.8	2 07.2	2 06.6	2 06.1	2 05.6	2 05.0	2 04.4	2 03.9	2 03.4	2 02.8
56	11.6	11.0	10.5	09.9	09.4	08.8	08.2	07.7	07.1	06.6	06.0
57	15.1	14.5	14.0	13.4	12.8	12.2	11.7	11.1	10.5	10.0	09.4
58	18.8	18.2	17.6	17.1	16.5	15.9	15.3	14.7	14.2	13.6	13.0
59	22.8	22.2	21.6	21.0	20.4	19.8	19.2	18.6	18.0	17.4	16.8
60	2 27.1	2 26.5	2 25.9	2 25.2	2 24.6	2 24.0	2 23.4	2 22.8	2 22.1	2 21.5	2 20.9
61	31.7	31.1	30.4	29.8	29.1	28.5	27.9	27.2	26.6	25.9	25.3
62	36.7	36.0	35.4	34.7	34.1	33.4	32.7	32.1	31.4	30.8	30.1
63	42.1	41.4	40.7	40.0	39.3	38.6	38.0	37.3	36.6	35.9	35.2
64	47.8	47.1	46.4	45.7	45.0	44.3	43.6	42.9	42.2	41.5	40.8
65	2 54.1	2 53.4	2 52.6	2 51.9	2 51.2	2 50.4	2 49.7	2 49.0	2 48.3	2 47.5	2 46.8
66	3 00.9	3 00.1	59.4	58.6	57.9	57.1	56.3	55.6	54.8	54.1	53.3
67	08.3	07.5	3 06.7	3 05.9	3 05.1	3 04.4	3 03.6	3 02.8	3 02.0	3 01.2	3 00.4
68	16.4	15.6	14.8	13.9	13.1	12.3	11.5	10.7	09.8	09.0	08.2
69	25.3	24.4	23.6	22.7	21.9	21.0	20.1	19.3	18.4	17.6	16.7
70	3 35.2	3 34.3	3 33.4	3 32.5	3 31.6	3 30.6	3 29.7	3 28.8	3 27.9	3 27.0	3 26.1
71	46.1	45.1	44.2	43.2	42.3	41.3	40.3	39.4	38.4	37.5	36.5
72	58.2	57.2	56.2	55.2	54.2	53.2	52.1	51.1	50.1	49.1	48.1

TO ESTABLISH A MERIDIAN AT CULMINATION OF POLARIS.

304. A very close approximation to a meridian may be had by remembering that Polaris very nearly reaches the meridian when it is in the same vertical plane with the star Delta (δ) in the constellation Cassiopeia. The vertical wire of the transit should be fixed upon Polaris, and occasionally brought down to the star Delta, to observe its approach to the same vertical line. When both stars are seen upon the wire, Polaris is very near the meridian. A small interval of time (as 3.7 min. in 1901) will then be allowed to pass, while Delta moves rapidly east and Polaris slightly east to the actual meridian. At that moment the cross wire should be placed upon Polaris, and the meridian firmly marked by stakes and tack-heads.

305. This method is practicable only when the star Delta is below the pole during the night; when it passes the meridian above the pole, it is too near the zenith to be of service, in which case the star Zeta (ζ), the last star but one in the tail of the Great Bear, may be used instead.

Delta (δ) Cassiopeiæ is on the meridian below Polaris and the pole, at midnight about April 10, and is, therefore, the proper star to use at that date and for some two or three months before and after.

Six months later, the star Zeta (ζ), in the tail of the Great Bear, will supply its place, and will be used in precisely the same manner.

The method given in this article for finding the true meridian can not be used with advantage on account of the haziness of the atmosphere near the horizon, at places below about 38° north latitude.

The diagram, drawn to scale, exhibits the principal stars of the constellations Cassiopeia and Great Bear, with Delta (δ) Cassiopeiæ, Zeta (ζ) Ursæ Majoris (also called Mizar), and Polaris on the meridian, represented by the straight line; Polaris being at lower culmination.

This method is given in Lalande's Astronomy and was practiced by Andrew Ellicott, in 1785, on the Ohio and Pennsylvania boundary.

306. In the above process, the interval of waiting time may be found for the proper year from the following data:

For Zeta Urs. Maj.	1901 ..... 3.0 min. 1910 ..... 6.1 "	annual increase 0.35 m.
For Delta Cass.	1901 ..... 3.7 min. 1910 ..... 6.7 "	annual increase 0.33 m.

The diagram held perpendicular to the line of sight directed to the pole, with the right hand side of the page uppermost, will represent the configuration of the constellations with Polaris near eastern elongation at midnight about July 10—inverted, it will show Zeta (ζ) of the Great Bear and Polaris on the meridian (the former below and the latter above the pole) at midnight about October 10; and held with left hand side uppermost the diagram will indicate relative situations for midnight about January 10, with Polaris near western elongation. The arrows indicate the direction of apparent motion. Zeta (ζ) of the Great Bear (also sometimes called the Great Dipper), was called Mizar by the ancient Arabians, and the small star near it Alcor. Mizar is the star nearest to the end star of the handle of the dipper.

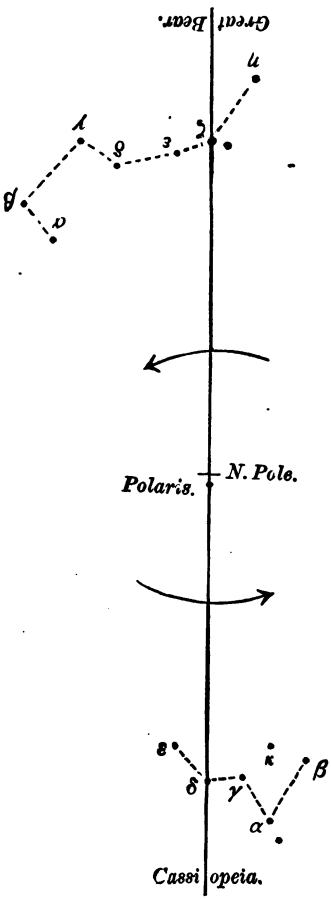

FIG. 1.

TO FIX A MERIDIAN AT OTHER TIMES, BY HOUR ANGLE.

307. The annexed diagram (fig. 2) will show in their proper relation the various aspects of Polaris in its daily apparent motion around the north-polar point.

This must be carefully studied, as the illustration of Table V, for finding at any hour the hour angle and azimuth of Polaris, and the resulting meridian, at times when more direct methods are not available.

308. Hour angle of Polaris. In fig. 2 the full vertical line represents a portion of the meridian passing through the zenith Z (the point di-

rectly overhead), and intersecting the northern horizon at the north point N, from which, for surveying purposes, the azimuths of Polaris are reckoned east or west. The meridian is pointed out by the plumb line

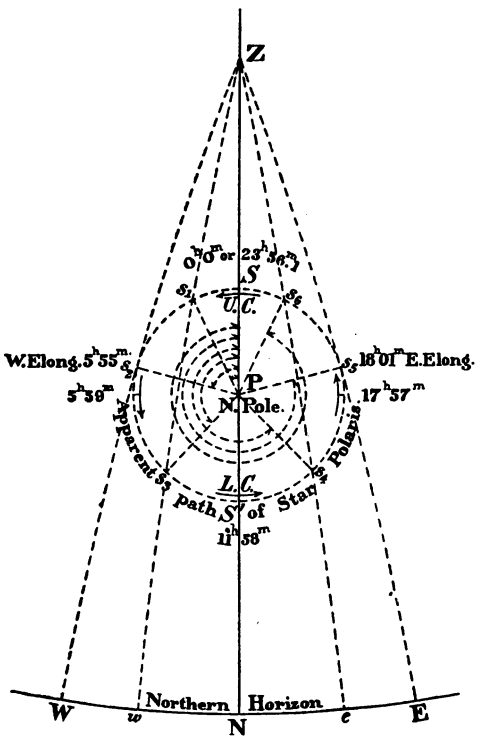

FIG. 2.

when it is in the same plane with the eye of the observer and Polaris on the meridian, and a visual representation is also seen in the vertical wire of the transit, when it covers the star on the meridian.

When Polaris crosses the meridian it is said to culminate; above the pole (at S), the passage is called the upper culmination, in contradistinction to the lower culmination (at S′).

309. In the diagram—which the surveyor may better understand by holding it up perpendicular to the line of sight when he looks toward the pole—Polaris is supposed to be on the meridian, where it will be about noon on April 10 of each year. The star appears to revolve around the pole, in the direction of the arrows, once in every $23^h\ 56^m.1$ of mean solar time; it consequently comes to and crosses the meridian, or culminates, nearly four minutes earlier each successive day. The apparent motion of the star being uniform, one quarter of the circle will (omitting fractions) be described in $5^h\ 59^m$, one half in $11^h\ 58^m$, and three quarters in $17^h\ 57^m$. For the positions s_1, s_2, s_3, etc., the angles SPs_1, SPs_2, SPs_3, etc., are called Hour Angles of Polaris for the instant the star is at s_1, s_2, or s_3, etc., and they are measured by the arcs Ss_1, Ss_2, Ss_3, etc., expressed (in these instructions) in mean solar (common clock) time, and are always counted from the upper meridian (at S), to the west, around the circle from $0^h\ 0^m$ to $23^h\ 56^m.1$, and may have any value between the limits named. The hour angles, measured by the arcs Ss_1, Ss_2, Ss_3, Ss_4, Ss_5, and Ss_6, are approximately $1^h\ 8^m$, $5^h\ 55^m$, $9^h\ 4^m$, $14^h\ 52^m$, $18^h\ 01^m$, and $22^h\ 48^m$ respectively; their extent is also indicated graphically by broken fractional circles about the pole.

310. Suppose the star observed at the point S_3; the time it was at S (the time of upper culmination), taken from the time of observation, will leave the arc Ss_3, or the hour angle at the instant of observation; similar relations will obtain when the star is observed in any other position; therefore, in general:

Subtract the time of Upper Culmination from the correct local mean time of observation; the remainder will be the Hour Angle of Polaris expressed in time, or the "argument for Table VII."

The observation will be made as directed on page 94 [page 31 hereof], modified as follows: There will be no waiting for the star to reach elongation; the observation may be made at any instant when Polaris is visible, the exact time being carefully noted.

TABLE V.

311. This table gives, in "Part I," the local mean time of the upper culmination of Polaris, on the 1st and 15th of each month, for the years 1901 to 1911, inclusive. The times decrease, in each year, to April 10, when they become zero; then, commencing at $23^h\ 56^m.1$, the times again decrease until the following April, and so on, continuously. The quantity in the column marked "Diff. for 1 day" is the decrease per day during the interval of time against which it stands, and answers for all the years marked in the table. For any intermediate date, the "Diff. for 1 day" will be multiplied by the days elapsed since the preceding tabular date, and the product subtracted from the corresponding time, to obtain the required time of upper culmination for the date under consideration. The table answers directly for 108° west longitude. The results of using it for other longitudes will contain an amount of error hardly appreciable, as the correction for longitude can not exceed one-tenth of a minute of time for each 9 degrees of longitude. A few examples will illustrate the use of the table.

1. Required the time of upper culmination of Polaris for a station in longitude 116° west, for March 3, 1904.

	h.	m.
Astron. time, U. C. of Polaris, 1904, March 1	2	47.0
Red for 2 days is $3^m.94 \times 2 = 7^m.9$ (Part II) subtract		7.9
Local mean time U. C. of Polaris, 1904, March 3	2	39.1

The required time may also be obtained by using the table in the opposite direction; by taking the time for March 15, and adding the reduction as follows:

	h.	m.
Astron. time, U. C. of Polaris, 1904, March 15	1	51.9
Red. for 12 days is $3^m.94 \times 12 = 47^m.3$, add		47.3
Local mean time U. C. of Polaris, 1904, March 3	2	39.2

In this case the two results are practically identical. If the computation is made both ways, the results will check each other.

312. Part II has been inserted to save the surveyor the little trouble of making multiplications; thus, for the above example, look in Part II, under the proper tabular difference, $3^m.94$, and opposite the 3d or 17th day of the month in the left-hand column is the correction 7^m9.

Computing from a preceding date, for days between April 11 and 15 of any year, the reduction in Part II will be greater than the tabulated time of culmination, in which case $23^h\ 56^m.1$ will be added, to make the subtraction possible.

2. Required, for a station in long. 90° west, the time of U. C. of Polaris for April 14, 1906:

	h.	m.
Astron. time, U. C. of Polaris, 1906, April 1 (Part I)	0	47.9
Add	23	56.1
Sum	24	44.0
Reduction to April 14 (Part II), subtract		51.1
Local mean time, U. C. of Polaris, April 14	23	52.9

Working from a following date, for days between 9th and 15th of April, the sum will exceed $23^h\ 56^m.1$, and when this occurs subtract $23^h\ 56^m.1$ from the sum, and the remainder will be the required time.

3. Required, for a station in long. 90° west, the time of U. C. of Polaris for April 10, 1903:

	h.	m.
Astron. time, U. C. of Polaris, 1903, April 15 (Part I)	23	48.5
Reduction for 5 days (Part II), add		19.6
Sum	24	8.1
Subtract	23	56.1
Local mean time, U. C. of Polaris, 1903, April 10	0	12.0

313. The surveyor should be careful to correctly employ Part II, Table V. When the table is used in regular order, the "Reduction" may be taken from Part II with the argument, "Day of the month" in left-hand column, or "Number of days elapsed" in right-hand column, as may be preferred. ("Argument," the quantity on which another quantity in a table depends.) In example 2, Part II, may be entered

in with the argument 13 days elapsed (from 1st to 14th) in right-hand column; then the reduction, 51^m, 1, results, as above written; but, when working from a following date (example 3), the day of the month in left-hand column can not be used.

Mistakes are often made by using the wrong column in Part I; as a matter of course, the time should always be taken out for the current year.

TABLE V.—*Local mean (astronomical) time of the upper culmination of Polaris, computed for longitude 108° (7 h. 12m.) west of Greenwich.*

[The time on line with any date in Part I is the hours and minutes elapsed (common watch time) since the preceding noon.]

Part I.

Date.	1901.	1902.	1903.	1904.	1905.	Diff. for 1 day.
	h. m.	h. m.	h. m.	h. m.	h. m.	m.
Jan. 1	6 39.5	6 41.0	6 42.4	6 43.9	6 41.4	3.95
15	5 44.2	5 45.7	5 47.1	5 48.6	5 46.1	3.95
Feb. 1	4 37.1	4 38.6	4 40.0	4 41.5	4 39.0	3.95
15	3 41.9	3 43.4	3 44.8	3 46.3	3 43.8	3.95
Mar. 1	2 46.6	2 48.1	2 49.5	2 47.0	2 48.5	3.94
15	1 51.5	1 53.0	1 54.4	1 51.9	1 53.4	3.94
Apr. 1	0 44.6	0 46.1	0 47.5	0 45.0	0 46.5	3.94
15	23 45.6	23 47.1	23 48.5	23 46.0	23 47.5	3.93
May 1	22 42.8	22 44.3	22 45.7	22 43.2	22 44.7	3.93
15	21 47.8	21 49.3	21 50.7	21 48.2	21 49.7	3.92
June 1	20 41.2	20 42.7	20 44.1	20 41.6	20 43.1	3.92
15	19 46.4	19 47.9	19 49.3	19 46.8	19 48.3	3.91
July 1	18 43.8	18 45.3	18 46.7	18 44.2	18 45.7	3.91
15	17 49.0	17 50.1	17 51.9	17 49.4	17 50.9	3.92
Aug. 1	16 42.4	16 43.9	16 45.3	16 42.8	16 44.3	3.92
15	15 47.6	15 49.1	15 50.5	15 48.0	15 49.5	3.92
Sept. 1	14 41.0	14 42.5	14 43.9	14 41.4	14 42.9	3.92
15	13 46.1	13 47.6	13 49.0	13 46.5	13 48.0	3.93
Oct. 1	12 43.3	12 44.8	12 46.2	12 43.7	12 45.2	3.93
15	11 48.3	11 49.8	11 51.2	11 48.7	11 50.2	3.93
Nov. 1	10 41.4	10 42.9	10 44.3	10 41.8	10 43.3	3.93
15	9 46.4	9 47.9	9 49.3	9 46.8	9 48.3	3.94
Dec. 1	8 43.3	8 44.8	8 46.2	8 43.7	8 45.2	3.94
15	7 48.1	7 49.6	7 51.0	7 48.5	7 50.0	3.95

TABLE V.—*Local mean (astronomical) time of the upper culmination of Polaris, computed for longitude 108° (7 h. 12m.) west of Greenwich*—Continued.

Part I.—Continued.

Date.	1906.	1907.	1908.	1909.	1910.	1911.	Diff. for 1 day.
	h. m.	h. m.	h. m.	h. m.	h. m.	h. m.	m.
Jan. 1.....	6 42.8	6 44.3	6 45.7	6 43 2	6 44.7	6 46.1	3.95
15.....	5 47.5	5 49.0	5 50.4	5 47.9	5 49.4	5 50.8	3.95
Feb. 1.....	4 40.4	4 41.9	4 43 3	4 40.8	4 42.3	4 43.7	3.95
15.....	3 45.2	3 46.7	3 48 1	3. 45.6	3 47.1	3 48.5	3.95
Mar. 1.....	2 49.9	2 51.4	2 48.9	2 50 3	2 51.8	2 53.2	3.94
15.....	1 54.8	1 56.3	1 53.8	1 55 2	1 56.7	1 58.1	3.94
Apr. 1.....	0 47.9	0 49.4	0 46.8	0 48 3	0 49.8	0 51.2	3.94
15.....	23 48.9	23 50.4	23 47.8	23 49.3	23 50.8	23 52.2	3 93
May 1.....	22 46.1	22 47.6	22 45.1	22 46.5	22 48.0	22 49.4	3.93
15.....	21 51.1	21 52.6	21 50 1	21 51.5	21 53.0	21 54.4	3.92
June 1.....	20 44.5	20 46 0	20 43.5	20 44.9	20 46.4	20 47.8	3.92
15.....	19 49.7	19 51.2	19 48.7	19 50.1	19 51.6	19 53.0	3.91
July 1	18 47.1	18 48.6	18 46.1	18 47.5	18 49.0	18 50 4	3 91
15.....	17 52.3	17 53.8	17 51.3	17 52.7	17 54.2	17 55.6	3 92
Aug. 1.....	16 45 7	16 47.2	16 44.7	16 46.1	16 47.6	16 49.0	3 92
15.....	15 50 9	15 52.4	15 49.9	15 51.3	15 52.8	15 54 2	3.92
Sept. 1.....	14 44.3	14 45.8	14 43.3	14 44 7	14 46.2	14 47.6	3.92
15.....	13 49.4	13 50.9	13 48.4	13 49.8	13 51.3	13 52.7	3 93
Oct. 1.....	12 46 6	12 48.1	12 45.6	12 47.0	12 48.5	12 49.9	3.93
15.....	11 51.6	11 53.1	11 50.6	11 52 0	11 53.5	11 54.9	3.93
Nov. 1.....	10 44 7	10 46 2	10 43 7	10 45 1	10 46.6	10 48 0	3 93
15.....	9 49.7	9 51.2	9 48 7	9 50.1	9 51 6	9 53.0	3 94
Dec. 1.....	8 46 6	8 48 1	8 45.6	8 47.0	8 48 5	8 49.9	3.94
15.....	7 51.4	7 52.9	7 50.4	7 51.8	7 53.3	7 54.7	3.95

TABLE V.—*Local mean (astronomical) time of the upper culmination of Polaris, computed for longitude 108° (7 h. 12m.) west of Greenwich*—Continued.

Part II.

Reduction of tabular times to *intermediate dates.*

Subtract the reduction when computing from a *preceding*, or add it when working a *following* date.

Day of the month.	Reduction. Arg.—"Diff. for 1 day."					No. of days elapsed.
	m. 3.91.	*m.* 3.92.	*m.* 3.93.	*m.* 3.94.	*m.* 3.95.	
	m.	*m.*	*m.*	*m.*	*m.*	
2 or 16.....	3.9	3.9	3.9	3.9	3.9	1
3 or 17.....	7.8	7.8	7.9	7.9	7.9	2
4 or 18.....	11.7	11.8	11.8	11.8	11.8	3
5 or 19.....	15.6	15.7	15.7	15.8	15.8	4
6 or 20.....	19.5	19.6	19.6	19.7	19.7	5
7 or 21.....	23.5	23.5	23.6	23.6	23.7	6
8 or 22.....	27.4	27.4	27.5	27.6	27.6	7
9 or 23.....	31.3	31.4	31.4	31.5	31.6	8
10 or 24.....	35.2	35.3	35.4	35.5	35.5	9
11 or 25.....	39.1	39.2	39.3	39.4	39.5	10
12 or 26.....	43.0	43.1	43.2	43.3	43.4	11
13 or 27.....	46.9	47.0	47.2	47.3	47.4	12
14 or 28.....	50.8	51.0	51.1	51.2	51.3	13
29.....	54.7	54.9	55.0	55.2	55.3	14
30.....	58.6	58.8	58.9	59.1	59.2	15
31.....	62.6	62.7	62.9	63.0	63.2	16

Applications of Tables V and VII.

4. Required the Hour Angle and Azimuth of Polaris, for a station in latitude 46° N., longitude 90° W., at 8h 24m p. m., November 7, 1910.

	h.	m.
Astronomical time of observation, 1910, Nov. 7	8	24.0
Equivalent to time of Nov. 6	32	24.0
Astron. time, U. C. Polaris, Nov. 1 (Table V, Part I)	10 43.6	
Reduction to Nov. 6[a] (Part II), subtract	[b] 19.7	
Astron. time, U. C. Polaris, Nov. 6	10 26.9, subtract	[c] 10 26.9
Hour Angle of Polaris, at observation	21	57.1
Subtract from	[d] 23	56.1
Time argument for Table VII	1	59.0
Azimuth of Polaris, at observation	0° 51′ E.	

5. Required the Hour Angle and Azimuth of Polaris, for a station in latitude 41° 12′ N., longitude 94° W., at 6h 16m a. m., Nov. 19, 1901.

	h.	m.
Astronomical time of observation, 1901, Nov. 18	18	16.0
Astron. time, U. C. Polaris, Nov. 15 (Table V, Part I)	9 46.4	
Reduction to Nov. 18 (Part II), subtract	11.8	
Astron. time, U. C. Polaris, Nov. 18	9 34.6, subtract	9 34.6
Hour Angle of Polaris at observation and Time Argument for Table VII	[e] 8	41.4
Azimuth of Polaris at observation (Table VII), 74′ or	[f] 1° 14′ W.	

[a] By reference to the above table the surveyor will observe that the times between Nov. 1 and 15 are greater than 8h 24m; consequently the culmination for one day earlier, Nov. 6, will be used; see directions on page 99; also section 313.

[b] From Part II, Table V, opposite 6th day of month and under "3.94m."

[c] To subtract, take 1 day from Nov. 7 and add its equivalent, 24h, to 8h 24m, making Nov. 6, 32h 24m (which is the time expressed by Nov. 7, 8h 24m); then subtract in the usual manner.

[d] See last clause of footnote, page 104 [Page 47 hereof].

[e] In case the Hour Angle comes out greater than 11h 58m, subtract it from 23h 56.1m. See example 4, above.

[f] The Hour Angle being less than 11h 58m, the Azimuth is west; see precepts, top of Table VII.

DIFFERENT OBSERVATIONS OF POLARIS.

314. To establish the meridian of any station and test the accuracy of courses derived from the sun, the deputy must use one or more of the following methods:

1. By upper culmination.
2. By lower culmination.
3. By east elongation.
4. By west elongation.
5. By hour-angle observation at some point in any of the quadrants included between these four points.

The exact local mean time of lower culmination or of either elongation will be deduced from Table V above, as follows:

FOR EAST ELONGATION.

315. Find the time of upper culmination for the given day and year and subtract $5^h\ 55^m$, unless this brings the time within the preceding astronomical day; in which case, instead of the subtraction, add $18^h\ 1^m$.

FOR WEST ELONGATION.

316. Find the time of upper culmination and add $5^h\ 55^m$, unless this brings the time within the succeeding astronomical day; in which case, instead of the addition, subtract $18^h\ 1^m$.

FOR LOWER CULMINATION.

317. Find the time of upper culmination, and add or subtract $11^h\ 58^m$, as may be found necessary to bring the result on the desired astronomical day.

Where the resulting time comes in daylight, another method must be chosen, to render the star visible, or the hour-angle table must be used. The following schedule of methods may be useful in selecting a process. The dates specified are the earliest and latest available.

TABLE VI.—*Times suitable for various observations.*

Obs. for—	Astr. day.	Time of upper culmination.	Add or subt.	Time of observation.
	1901.	h. m.	h. m.	h. m.
Eastern elongation.	Apr. 12	0 1.5—past noon.....	+18 1	18 2.5—morning twilight.
	Apr. 13	23 53.6—near noon.....	− 5 55	17 58.6—morning twilight.
	Oct. 15	11 48.5—near midnight.	− 5 55	5 53.5—early evening.
Western elongation.	Oct. 15	11 48.5—near midnight.	+ 5 55	17 43.5—morning twilight.
	Apr. 12	0 1.5—past noon.....	+ 5 55	5 56.5—early evening.
	Apr. 13	23 53.6—near noon.....	−18 1	5 52.6—early evening.
Lower culmination.	Jan. 15	5 44.4—early evening..	+11 58	17 42.4—morning twilight.
	July 15	17 49.2—early morning.	−11 58	5 51.2—early evening.

FOR HOUR-ANGLE OBSERVATIONS. (TABLE VII.)

318. This table gives, for various hour angles, expressed in mean solar time, and for even degrees of latitude from 30 to 50 degrees, the Azimuths of Polaris for 11 years, computed for average values of the north polar distance of the star—the arguments being the hour angle (or $23^h\ 56^m.1$, minus the hour angle, when the latter exceeds $11^h\ 58^m$), which is termed the time Argument;[a] and the latitude of the place of observation. The table is so extended that azimuths may be taken out by mere inspection and all interpolation avoided, except such as can be performed mentally.

The hours of the "time arguments" are placed in the columns headed "Hours," on left of each page. The minutes of the time arguments will

[a] The vertical diameter SS′, fig. 2, divides the apparent path of Polaris into two equal parts, and for the star at any point s_6 on the east side, there is a corresponding point s_1 on the west side of the meridian, for which the azimuth Nw, is equal to the azimuth Ne. The arc $Ss_1S's_6$, taken from the entire circle (or $23^h\ 53^m.1$), leaves the arc Ss_6, and its equal, Ss_1, expressed in time, may be used to find, from Table VII, the azimuth Nw, which is equal to Ne.

The hour angles entered in Table VII include only those of the west half of the circle ending at S′, and when an hour angle greater than $11^h\ 53^m$ results from observation, it will be subtracted from $23^h\ 53^m.1$, and the remainder will be used as the "time argument" for the table. The surveyor should not confound these two quantities. The hour angle itself always decides the direction of the azimuth and defines the place of the star with reference to the pole and meridian, as noted at top of Table VII. See examples below Table V, page 102. [Page 45 hereof.]

be found in the columns marked "m.," under the years for which they are computed, and they are included between the same heavy zigzag lines which inclose the hours to which they belong.

The time arguments are given to the nearest half minute; the occurrence of a period after the minutes of any one of them indicates that its value is 0.5^m greater than printed, the table being so arranged to economize space.

319. The table will be used as follows: *Find the* HOURS *of the time argument in the left-hand column of either page; then, between the heavy lines which inclose the hours, find the* MINUTES *in the column marked at the top with the current year. On the same horizontal line with the* MINUTES, *the azimuth will be found under the given latitude, which is marked at the top of the right-hand half of each page.* Thus, for 1904, time argument, $0^h\ 43^m$, latitude 36°; find 0^h on left-hand page and under 1904, find 43^m, on ninth line from the top, and on same line with the minutes, under latitude 36°, is the azimuth 0° 17′. For 1908, time argument $9^h\ 33\frac{1}{2}^m$, lat. 48°, the azimuth is 1° 1½′, found on the 21st line from top of right-hand page.

If the exact time argument is not found in the table, the azimuth should be proportioned to the difference between the given and tabular values of said argument.

The table has been arranged to give the azimuths by simple inspection. No written arithmetical work is required, all being performed mentally. It will always be sufficient to take the nearest whole degree of latitude and use it as above directed, except for a few values near the top of either page, where the difference of azimuths, for 2° difference of latitude, amounts to 4 or 5 minutes of arc.

320. The attention of the surveyor is directed to the fact that he should always use one day of twenty-four hours as the unit, when he subtracts the time of culmination from the time of observation. See example 4, page 102 [page 45 hereof]. In any case when the time of upper culmination, taken from Table V, for the given date, would be numerically greater than the astronomical time of observation, the former time will be taken out for a date one day earlier than the date of observation. The surveyor will decide when such condition exists by

comparing the time given in the table with his astronomical time of observation. See example 4 and explanations in footnotes, page 102.

321. The watch time to be used when making observations on Polaris at all times, except elongation should be as accurate as can be obtained. Looking at Table VII, near the top of page 106 [page 52 hereof], the surveyor will observe that for a difference of four minutes in the time argument, there is a change of about two minutes in azimuth; consequently, to obtain the azimuth to the nearest whole minute of arc, the local mean time, upon which all depends, should be known within two minutes. When the surveyor uses a solar instrument he can readily determine the time for himself during the afternoon before observing Polaris, or in the morning after observation, and, without moving the hands of his watch, apply the necessary correction to his observed watch time, as exemplified in Specimen Field Notes, page 149. [General Surveying Manual.] When the surveyor uses standard railroad time he will correct the same for the difference of longitude between his station and the standard meridian for which the time is given, at the rate of four minutes of time for each degree of the difference in arc. Thus, if the difference of longitude is 6° 45′, the equivalent in time will be 27 minutes. The difference of longitude may be taken from a good map. The number of seconds taken from the fifth column of Table XII (opposite the proper latitude), multiplied by the number of ranges, will give the correction for longitude in seconds of time. The correction will be subtracted from the standard railroad time of observation, when the surveyor's station is west, or added when east of the standard meridian, as the case may require, to obtain local time. It is immaterial where the surveyor obtains the standard time, provided he gets it right; a result which will be gained most easily by a direct personal comparison at a telegraph office.

322. The following Table VII thus enables the surveyor to obtain the hour angle and azimuth of Polaris at any hour and minute from 1901 to 1911 inclusive, in latitudes 30° to 50°, thus combining in two pages the essentials which under ordinary methods would require twenty. This condensed table was first given in the Manual of 1890, for dates which are now past. It has now been extended to a date 11 years later, with a slight change of plan.

TABLE VII.—*Azimuths of Polaris for the use of land surveyors.*

POLARIS *ABOVE* THE POLE.

[The hour angles are expressed in *mean solar* time. The occurrence of a period after minutes of time or of an hour angle indicates that its value is $0^m.5$ greater than printed.]

STAR AND AZIMUTH.

W. of N. when hour angle is *less* than $11^h\ 58^m$.
E. of N. when hour angle is *greater* than $11^h\ 58^m$.

Time argument, the star's hour angle (or $23^h\ 56^m.1$ *minus* the star's hour angle), for the year—

To determine the true meridian, the azimuth will be laid off to the *east* when the hour angle is *less* than $11^h\ 58^m$, and to the *west* when *greater* than $11^h\ 58^m$.

Hours.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.	1911.	Azimuths for latitude. 30°	32°	34°	36°	38°	40°	42°	44°	46°	48°	50°
h.	m.	m.	m.	m.	m.	m.	m.	m.	m.	m.	m.	′	′	′	′	′	′	′	′	′	′	′
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	4.	4.	4.	5	5	5	5	5	5	5	5	2	2	2	2	2	2	2	2	2	2.	2.
	9.	9.	9.	9.	9.	9.	9.	9.	10	10	10	3.	3.	3.	4	4	4	4	4	4.	4.	5
	14	14	14	14.	14.	14.	14.	14.	14.	14.	15	5.	5.	5.	5.	6	6	6	6.	6.	7	7
	19	19	19	19	19	19	19.	19.	19.	19.	19.	7	7	7.	7.	8	8	8.	8.	9	9	9.
	23.	23.	23.	24	24	24	24	24.	24.	24.	24.	9	9	9	9.	9.	10	10.	10.	11	11.	12
	28.	28.	28.	28.	29	29	29	29	29.	29.	29.	10.	11	11	11.	11.	12	12.	13	13.	14	14.
	33	33	33.	33.	33.	34	34	34	34.	34.	34.	12.	12.	13.	13	13.	14	14.	15	15.	16	17
	38	38	38	38.	38.	38.	39	39	39	39.	39.	14	14.	14.	15	15.	16	16.	17	18	18.	19
	42.	42.	43	43	43.	43.	44	44	44	44.	44.	16	16	16.	17	17.	18	18.	19.	20	21	21.
	47.	47.	48	48	48	48.	48.	49	49	49.	49.	17.	18	18	19	19.	20	20.	21.	22.	23	24
	52	52.	52.	53	53	53.	53.	54	54	54.	54.	19.	20	20.	21	21.	22	22.	23.	24.	25.	26.
	57	57.	57.	58	58	58.	58.	59	59	59.	0	21.	21.	22	22.	23.	24	25	26	27	28	29
1	2	2	2.	3	3	3.	3.	4	4.	4.	5	23	23.	24	24.	25	26	27	28	29	30	31.
	7	7	7.	7.	8	8.	8.	9	9.	9.	10	25	25.	26	26.	27	28	29	30	31.	32.	34
	12	12	12.	13	13	13.	14	14.	14.	15	15	27	27	27.	28.	29	30	31	32	33.	35	36.
	17	17	17.	18	18	18.	19	19.	19.	20	20.	28.	29	29.	30	31	32	33	34.	36	37.	39
	22	22	22.	23	23.	23.	24	24.	25	25.	26	30.	31	31.	32	33	34	35	36.	38	39.	41.
	27	27	27.	28	28.	29	29.	29.	30	30.	31	32	32.	33	34	35	36	37	38.	40	42	43.

	32.	32.	33	33.	33.	34	34.	35	35.	36	36.	33.	34.	35	36	37	38	39.	41	42.	44	46
	37	37.	38	38.	39	39.	40	40.	41	41.	42	35.	36	37	38	39	40	41.	43	44.	46.	48.
	42.	43	43.	44	44.	45	45.	46	46.	47	47.	37	38	38.	39.	40.	42	43.	45	46.	48.	50.
	47.	48	48.	49	50	50.	51	51.	52	52.	53	39	39.	40.	41.	42.	44	45.	47	49	51	53
	53	53.	54	54.	55	55.	56.	57	57.	58	58.	40.	41.	42.	43.	44.	46	47.	49	51	53	55
	58.	59	59.	0	0.	1.	2	2.	3	4	4.	42.	43	44	45.	46.	48	49.	51.	53.	55.	57.
2	4	4.	5	6	6.	7	7.	8.	9	9.	10.	44	45	46	47	48.	50	51.	53.	55.	57.	60
	9	10	10.	11.	12	12.	13.	14	15	15.	16.	46	47	48	49	50.	52	53.	55.	57.	60	62.
	15	16	16.	17	18	18.	19.	20	21	21.	22.	47.	48.	49.	51	52.	54	56	57.	60	62	64.
	21	21.	22.	23	24	24.	25.	26	27	28	28.	49.	50.	51.	53	54.	56	58	60	62	64.	67
	27	27.	28.	29	30	30.	31.	32.	33	34	35	51	52	53.	55	56.	58	60	62	64.	66.	69.
	33	33.	34.	35	36	37	38	38.	39.	40.	41.	53	54	55.	56.	58.	60	62	64	66.	69	72
	39	40	40.	41.	42.	43.	44.	45	46	47	48	54.	56	57	58.	60	62	64	66	68.	71.	74.
	45	46	47	48	49	50	51	52	53	54	55	56.	57.	59	60.	62	64	66	68.	71	73.	76.
	51.	52.	53.	54.	55.	56.	57.	58.	59.	1	2	58	59.	61	62.	64	66	68	70.	73.	76	79
	58.	59.	0.	1.	2.	3.	4.	6	7	8	9	60	61.	63	64.	66	68	70	72.	75	78	81.
3	5.	6.	7.	8.	10	11	12	13	14.	15.	17	61.	63	64.	66	68	70	72	74.	77.	80.	84
	12.	13.	14.	16	17	18.	19.	21	22	23.	25	63.	65	66.	68	70	72	74.	77	79.	82.	86
	19.	21	22	23.	25	26	27.	29	30.	31.	33	65	66.	68.	70	72	74	76.	79	82	85	88.
	27.	28.	30	31.	33	34.	35.	37	38.	40.	42	67	68.	70	72	74	76	78.	81	84	87	91
	35.	37	38.	39.	41	43	44.	46	47.	49.	51	69	70.	72	74	76	78	80.	83	86	89.	93.
	44	45.	47	48.	50	52	53.	55	57	59	0.	70.	72	74	75.	77.	80	82.	85.	88.	91.	95.
	53	54.	56	58	59.	1.	3.	5.	7.	9.	11.	72.	74	76	77.	79.	82	84.	87.	90.	94	98
4	2.	4.	6.	8	10	12.	14.	16.	19	21	23.	74	76	77.	79.	81.	84	86.	89.	92.	96	100.
	13	15	17.	19.	22	24	26.	29	32	34.	37.	76	77.	79.	81.	83.	86	88.	91.	95	98.	103
	24.	27	29.	32	34.	37.	40.	43.	46.	50	53.	77.	79.	81.	83.	85.	88	90.	94	97	101	105
	38	40.	43.	46.	50	53.	57.	2	6.	11	16.	79.	81.	83	85	87.	90	93	96	99.	103.	107.
	54	57.	1.	5	10	16	23.	32	42.			81	83	85	87	89.	92	95	98	101.	105.	110
5	16	22	29.	40.								83	85	87	89	91.	94	97	100	103.	107.	112

TABLE VII.—*Azimuths of Polaris for the use of land surveyors*—Continued.

POLARIS *BELOW* THE POLE.

[The hour angles are expressed in *mean solar* time. The occurrence of a period after minutes of time or of an hour angle indicates that its value is 0m.5 greater than printed.]

STAR AND AZIMUTH.

W. of N. when hour angle is *less* than 11h 58m.
E. of N. when hour angle is *greater* than 11h 58m.

To determine the true meridian, the azimuth will be laid off to the *east* when the hour angle is *less* than 11h 58m, and to the *west* when *greater* than 11h 58m.

Time argument, the star's hour angle (or 23h 56m.1 *minus* the star's hour angle), for the year—

Hours.	1901.	1902.	1903.	1904.	1905.	1906.	1907.	1908.	1909.	1910.	1911.	Azimuths for latitude— 30°	32°	34°	36°	38°	40°	42°	44°	46°	48°	50°
h.	m.	m.	m.	m.	m.	m.	m.	m.	m.	m.	m.	′	′	′	′	′	′	′	′	′	′	′
6	34	28	20.	9.								83	85	87	89	91.	94	97	100	103.	107.	112
	56	52.	48.	45	40.	34	27	18	8			81.	83	85	87	89.	92	95	98	101.	105.	109.
7	12.	10	7	4	0.	56.	52.	48.	44	39	34	79.	81.	83	85	87.	90	93	96	99.	103	107
	26	23.	21	18.	16	13	10	7	4	0.	57	78	79.	81.	83.	85.	88	90.	93.	97	100.	104.
	37.	35.	33.	31.	29	26.	24	21.	19	16	13	76	77.	79.	81.	83.	86	88.	91.	95	98.	102
	48.	46.	44.	42.	40.	38.	36.	34.	32	29.	27	74.	76	77.	79.	81.	84	86.	89.	92.	96	100
	58	56.	55	53	51.	49.	47.	45.	43.	41.	39.	72.	74	76	77.	79.	82	84.	87.	90.	94	97.
8	7.	6	4	2.	1	59.	57.	56	54	52.	50.	71	72.	74	76	77.	80	82.	85.	88.	91.	95
	16	14.	13	11.	10	8.	7	5.	4	2.	1	69	70.	72	74	75.	78	80.	83	86	89	92.
	24	23	21.	20	18.	17.	16	14.	13	11.	10	67.	68.	70.	72	74	76	78.	81	84	87	90
	32	31	29.	28	27	25.	24.	23	21.	20.	19	65.	67	68.	70	72	74	76.	79	81.	84.	88
	39.	38.	37	36	35	33.	32.	31	30	28.	27.	64	65	66.	68	70	72	74.	77	79.	82.	85.
	47	46	44.	43.	42.	41.	40	39	38	36.	35.	62	63.	64.	66.	68	70	72	74.	77.	80	83
	54	53	52	50.	49.	48.	47.	46.	45.	44.	43	60.	61.	63	64.	66	68	70	72.	75	78	80.

9	0.	59.	58.	57.	56.	55.	54.	53.	52.	51.	50.	58.	59.	61	62.	64	66	68	70.	73	75.	78
	7.	6.	5.	4.	3.	2.	1.	1	0	59	58	57	58	59	60.	62.	64	66	68	70.	73	76
	13.	13	12	11	10.	9.	8.	7.	6.	5.	5	55	56	57.	59	60.	62	64	66	68.	71	73.
	20	19	18.	17.	17	16	15	14.	13.	12.	11.	53.	54.	55.	57	58.	60	62	64	66	68.	71
	26	25.	24.	24	23	22.	21.	20.	20	19	18	51.	52.	53.	55	56.	58	60	62	64	66.	68.
	32	31.	31	30	29.	28.	28	27	26.	25.	24.	49.	50.	52	53	54.	56	58	59.	62	64	66.
	38	37.	37	36	35.	35	34	33.	32.	32	31	48	49	50	51	52.	54	55.	57.	59.	61.	64
	44	43.	43	42	41.	41	40	39.	38.	38	37.	46	47	48	49.	50.	52	53.	55.	57.	59.	61.
	50	49	48.	48	47.	47	46	45.	45	44	43.	44.	45.	46.	47.	48.	50	51.	53.	55	57	59
	55.	55	54.	54	53	52.	52	51.	51	50	49.	42.	43.	44.	45.	46.	48	49.	51	53	55	57
10	1	0.	0	59.	59	58.	57.	57	56.	56	55.	41	41.	42.	43.	44.	46	47.	49	50.	52.	54.
	6.	6	5.	5	4.	4	3.	3	2.	2	1.	39	40	40.	41.	43	44	45.	47	48.	50	52
	12	11.	11	10.	10	9.	9	8.	8	7.	7	37.	38	39	40	41	42	43.	45	46.	48	49
	17.	17	16.	16	15.	15	14.	14	13.	13	12.	35.	36	37	38	39	40	41	42.	44	45.	47.
	23	22.	22	21.	21	20.	20	19.	19.	19.	18.	34	34.	35	36	37	38	39	40.	42	43.	45
	28	27.	27.	27	26.	26	25.	25	25	24.	24	32	32.	33.	34	35	36	37	38.	39	41	42.
	33.	33	32.	32	32	31.	31	30.	30	30	29.	30	31	31.	32	33	34	35	36	37	39	40
	38.	38	38	37.	37	36.	36.	36	35.	35	35	28.	29	29.	30.	31	32	33	34	35.	36.	38
	43.	43.	43	43	42.	42	42	41.	41.	41.	40.	40	26.	27	28	28.	29	30	31	32	33	34.	35.
	49	48.	48	48	48	47.	47	47	46.	46.	46	45.	25	25.	26	26.	27	28	29	30	31	32	33
	54	53.	53	53	53	52.	52.	52	52	51.	51	51	23	23.	24	24.	25.	26	27	27.	28.	29.	31
	59	58.	58.	58	58	58	57.	57.	57	57	56.	56	21.	22	22	22.	23	24	25	25.	26.	27.	28.
11	4	3.	3.	3	3	2.	2.	2	2	1.	1.	19.	20	20.	21	21.	22	22.	23.	24	25	26
	9	8.	8.	8.	8	8	7.	7	7	7	6.	18	18	18.	19	19.	20	20.	21.	22	23	23.
	14	13.	13.	13.	13	13	12.	12.	12.	12	12	16	16.	16.	17	17.	18	18.	19	20	20.	21.
	19	18.	18.	18.	18	18	18	17.	17.	17.	17	14	14.	15	15	15.	16	16.	17	17.	18	19
	24	23.	23.	23.	23	23	23	22.	22.	22.	22	12.	12.	13	13.	13.	14	14.	15	15.	16	16.
	28.	28.	28.	28.	28.	28	28	28	27.	27.	27.	10.	11	11	11.	11.	12	12.	12.	13	13.	14
	33.	33.	33.	33.	33	33	33	33	33	32.	32.	9	9	9	9.	9.	10	10.	10.	11	11.	12
	38.	38.	38.	38.	38	38	38	38	38	38	37.	7	7	7.	7.	8	8	8	8.	9	9	9.
	43.	43.	43.	43.	43	43	43	43	43	43	43	5.	5.	5.	5.	6	6	6	6.	6.	7	7
	48.	48.	48	48	48	48	48	48	48	48	48	3.	3.	3.	4	4	4	4	4.	4.	4.	4.
	53	53	53	53	53	53	53	53	53	53	53	2	2	2	2	2	2	2	2	2	2.	2.
	58	58	58	58	58	58	58	58	58	58	58	0	0	0	0	0	0	0	0	0	0	0

RELATIVE POSITIONS OF THE MERIDIAN AND POLARIS.

323. If the observation is made after in point of time and within $11^h\ 58^m$ of the culmination preceding, the star is obviously west of the true meridian and the azimuth must be laid off to the east. If the observation is made before in point of time and within $11^h\ 58^m$ of the culmination following, the star is obviously east of the meridian and the azimuth must be laid off to west.

A very good way to tell the position of Polaris as to being either west or east of the meridian, is accomplished by noticing the relative position of Polaris and the star Mizar in the handle of the "Great Dipper." These stars Mizar and Polaris are diametrically opposite each other on a line passing almost exactly through the pole of the earth's axis. Obviously if Mizar is in the eastern sky, Polaris is west of the meridian, etc.

The following four examples illustrate any difficulties in the use of the tables:

EVENING OBSERVATIONS.

324. February 20, 1903, at $7^h\ 42^m.5$ p. m., local mean time, I observe Polaris in position and mark the direction of the sight upon the ground. I notice that Mizar is in the eastern sky. Station in southern California, latitude 36°, longitude 117°.

	h.	m.	h.	m.
Time of observation			7	42.5
From Table V, U. C. Polaris, February 15	3	44.8		
Reduction to February 20		19.7	3	25.1
Time elapsed since preceding culmination			4	17.4

From Table VII, corresponding azimuth is 81′.5.

February 21 I lay off the meridian 1° 21′.5 to the east of the line of sight of observation.

325. May 9, 1903, at $8^h\ 56^m.4$ p. m., local mean time, I observe Polaris in position and mark the line of sight upon the ground. I notice that Mizar is in the eastern sky. Station in northeastern Min-

nesota, latitude 48°, longitude 90°. The nearest culmination is that of May 8.

	h.	m.
Time of observation May 9, $8^h\ 56^m.4$, or May 8	32	56.4
From Table V, U. C., May 1	22 45.7	
Reduction to May 8	27.5	22 18.2
Time elapsed since preceding culmination	10	38.2

From Table VII, corresponding azimuth is 36′.5.

May 10 I lay off the meridian 0° 36′.5 to the east of the line of observation of Polaris.

MORNING OBSERVATIONS.

326. May 10, 1903, at $5^h\ 13^m$ a. m., local mean time, or May 9, $17^h\ 13^m$, astronomical time, I observe Polaris in position and mark the line of sight upon the ground. I notice that Mizar is in the western sky. Station in northeastern Minnesota, latitude 48°, longitude 90°.

	h.	m.	h.	m.
Time of observation, May 9			17	13.0
From Table V, U. C., May 1	22	45.7		
Reduction to May 9		−31.4	22	14.3
Time to elapse to next following culmination			5	1.3

From Table VII, corresponding azimuth is 105′.5.

After daylight I lay off the meridian 1° 45′.5 to the west of the line of observation.

327. February 21, 1903, at $5^h\ 10^m$ a. m., local mean time, or February 20, $17^h\ 10^m$, astronomical time, I observe Polaris in position and mark the line of sight upon the ground. I notice that Mizar is in the western sky. Station in southern California, latitude 36°, longitude 117°. The nearest culmination is on February 21.

	h.	m.	h.	m.	h.	m.
Time of observation, February 20					17	10.0
From Table V, U. C., February 15	3	44.8				
Reduction to February 21		−23.7				
	3	21.1	+24	0	=27	21.1
Time to elapse to next following culmination					10	11.1

From Table VII, corresponding azimuth is 40′.0.

After daylight I lay off the meridian 0° 40′ to the west of the line of observation.

OBSERVATIONS AT ELONGATION.

328. Approximately 5^h 55^m later than the time of culmination Polaris reaches its maximum western azimuth, or western elongation. Eastern elongation occurs the same amount of time earlier than upper culmination.

When observing at elongation the time is not at argument, except to warn the observer of the approaching condition. In the observation the motion of the star is slowly followed until the maximum azimuth is actually observed to have been reached by the star receding. The line of sight of the maximum position in azimuth noticed in the observation is marked upon the ground.

329. In Table IV is tabulated the azimuth of Polaris when at elongation, for any date from 1901 to 1911, inclusive, and for any latitude between 30° and 50°, inclusive.

The following two examples illustrate observations made at elongation:

WESTERN ELONGATION.

330. March 10, 1903, I wish to observe Polaris at western elongation; my latitude is 40°.

	h.	m.
From Table V, U. C., March 1	2	49.5
Reduction to March 10		−35.5
Time to add until elongation	+5	55
Time of western elongation	8	9

About 8 p. m. I commence observing the western progress of Polaris; when the star begins to recede, I mark the maximum position in azimuth upon the ground. From Table IV the corresponding azimuth is found to be 1° 34′.8. March 11, I lay off the meridian 1° 34′.8 to the east of the line of the observation.

EASTERN ELONGATION.

331. September 3, 1903, I wish to observe Polaris at eastern elongation; my latitude is 48°.

	h.	m.
From Table V, U. C., September 1	14	43.9
Reduction to September 3		− 7.9
Time to subtract for elongation	−5	55
	8	41

About $8^h\ 30^m$ I commence observing the eastern progress of Polaris; when the star begins to recede I mark the maximum position in azimuth upon the ground. From Table IV the corresponding azimuth is found to be 1° 48′.6. September 4 I lay off the meridian 1° 48′.6 to the west of the line of sight.

* * * * * * *

APPENDIX C.

SPECIMEN FIELD NOTES AND FORMS.

[4—689.]

APPLICATION TO UNITED STATES SURVEYOR-GENERAL FOR SURVEY OF MINING CLAIMS.

....., ...

....., 19..

UNITED STATES SURVEYOR-GENERAL,

....

SIR: ....., claimant.., hereby make.. application for an official survey, under the provisions of chapter 6, title 32, of the Revised Statutes of the United States, and regulations and instructions thereunder, of the mining claim known as the ....., situate in ..... mining district, ... county, ..., in section ....., township No. ....., range No. ..... Said claim is based upon a valid location made on ....., 19.., and duly recorded on ....., 19.., and is fully described in the duly certified copy of the record of the location certificate, filed herewith. Said certificate contains the name of the locator, the date of location, and such a definite description of the claim by reference to natural objects or permanent monuments as will identify the claim, and said location has been distinctly marked by monuments on the ground, so that its boundaries can be readily traced.

..... request that you will send ..... an estimate of the amount required to defray the expenses of platting and other work in your office, required under the regulations, that ..... may make proper deposit therefor, and that thereupon you will cause the survey to be made by....., United States mineral surveyor, and proper action to be taken thereon by your office, as required by the United States mining laws and regulations thereunder.

...., *Claimant.*

P. O. address.....

..... county,

.....

[4—682.]

ORDER FOR MINERAL SURVEY.

DEPARTMENT OF THE INTERIOR,
OFFICE OF U. S. SURVEYOR-GENERAL,

...., 19..

To ....,
U. S. Mineral Surveyor,
....

SIR: Application has been filed in this office by ....., dated ....., 19.., for an official survey of the mining claim of ....., known as the ....., situate in ..... mining district, ... county, in section ....., township No. ....., range No. ....., which claim is based upon a location made on ....., 19.., and duly recorded on ....., 19.., and is fully described in the duly certified copy of the record of the location certificate, filed by the applicant.. for said survey, a copy of which is herewith inclosed. You are hereby directed to make the survey of said claim in strict conformity with existing laws, official regulations, and instructions thereunder, and to make proper return to this office. Said survey will be designated as survey No. .....

Very respectfully,

....,
U. S. Surveyor-General for .....

[4—683.]

SPECIMEN FIELD NOTES.

Mineral Survey No. 20,000, A and B.

Lot No. .....

Montrose Land District.

FIELD NOTES

OF THE SURVEY OF THE MINING CLAIM OF

The Noonday Tunnel Gold Mining and Milling Company,

KNOWN AS THE

Matchless, Mascot, Noonday, Bryan and Little Olive Lodes,

and

..... Bryan Mill Site .....
..... Gold Brick ..... Mining District,
Gunnison County, Colorado.

Sections 12 and 13, Township 50 N,
Range 3 E. of N. M. P. M.

Surveyed under instructions dated December 1, 1906,
By O. M. THAYER,
U. S. Mineral Surveyor.

Claim located ....., 1 .....
Survey commenced May 6, 1907.
Survey completed May 11, 1907.
Address of claimant:
E. J. BROWN, *Secretary,*
Pueblo, Colorado.

DATES OF AMENDED LOCATIONS.

Matchless, Noonday, Bryan, and Little Olive Lodes, May 7, 1906.
Mascot Lode, June 4, 1906.
Bryan Mill Site, May 7, 1906.

SURVEY NO. 20,000 A and B.

MATCHLESS LODE.

Beginning at Cor. No. 1.

On line 2–3, Mascot lode, of this survey.

A pine post, 4 ft. long, 5 ins. square, set 2 ft. in the ground, with mound of stone, scribed MAT. 1–20000 A, whence

The NE. Cor., T. 50 N., R. 3 E., of N. M. P. M., bears N. 18° 53′ 20″ E., 9,175.32 ft.

FEET.	
	Thence N. 51° 45′ W.
250. 7	To Cor. No. 2.
	A pine post, 4 ft. long, 5 ins. square, set 2 ft. in the ground, with mound of stone, scribed MAT. 2–20000 A.
	Thence S. 25° 06′ W.
535. 68	Intersect line 4–1, Noonday lode, of this survey.
1, 006. 10	Intersect line 2–3, Noonday lode, of this survey.
1, 016	To Cor. No. 3.
	A pine post, 4 ft. long, 5 ins. square, set 2 ft. in the ground, with mound of stone, scribed MAT. 3–20000 A.
	Thence S. 51° 45′ E.
10. 32	Intersect line 2–3, Noonday lode, of this survey.
250. 7	To Cor. No. 4.
	On line 2–3, Mascot lode, of this survey.
	A pine post, 4 ft. long, 5 ins. square, set 2 ft. in the ground, with mound of stone, scribed MAT. 4–20000 A, whence
	Cor. No. 4, Noonday lode, of this survey, bears S. 47° 38′ E., 276.96 ft.

SURVEY NO. 20,000 A and B—Continued.

MATCHLESS LODE—continued.

FEET.	
	Thence N. 25° 06′ E.
239.96	Intersect line 4–1, Noonday lode, of this survey.
1,016	To Cor. No. 1, the place of beginning.

MASCOT LODE.

Beginning at Cor. No. 1.

A pine post, 4 ft. long, 5 ins. square, set 2 ft. in the ground, with mound of stone, scribed MAS. 1–20000 A, whence

The NE. Cor., T. 50 N., R. 3 E., of N. M. P. M., bears N. 16° 49′ 20″ E. 8,976.06 ft.

Cor. No. 3, Sur. No. 12479, A. Am. Queen No. 2 lode, The Cortland Gold and Silver Mining Company claimant, bears S. 39° 49′ 30″ W. 406.88 ft.

Cor. No. 3, Sur. No. 17854, Grant lode, The Cortland Gold and Silver Mining Company claimant, bears S. 40° 28′ W. 562.25 ft.

Cor. No. 1, Sur. No. 17854, Brown lode, bears S. 6° 44′ W. 490 ft.

	Thence N. 64° 54′ W.
123.90	Intersect line 3–4, Sur. No. 17854, Grant lode, at N. 27° 45′ E. 542.73 ft. from Cor. No. 3.
207.88	Intersect line 3–4, Sur. No. 12479, A. Am. Queen No. 2 lode, at N. 10° 14′ E. 407.15 ft. from Cor. No. 3.
300	To Cor. No. 2.
	A pine post, 4 ft. long, 5 ins. square, set 2 ft. in the ground, with mound of stone, scribed MAS. 2–20000 A.

SURVEY NO. 20,000 A and B—Continued.

MASCOT LODE—continued.

FEET.	
	Thence S. 25° 06′ W.
238.77	Cor. No. 1, Matchless lode, of this survey.
1,014.81	Intersect line 4–1, Noonday lode, of this survey.
1,254.77	Cor. No. 4, Matchless lode, of this survey.
1,374	To Cor. No. 3.
	A pine post, 4 ft. long, 5 ins. square, set 2 ft. in the ground, with mound of stone, scribed MAS. 3–20000 A.
	Thence S. 64° 54′ E.
229.72	Intersect line 3–4 and 1–2, Noonday and Bryan lodes, of this survey, respectively.
292.39	Intersect line 4–1, Bryan lode, of this survey.
300	To Cor. No. 4.
	A pine post, 4 ft. long, 5 ins. square, set 2 ft. in the ground, with mound of stone, scribed MAS. 4–20000 A, whence Cor. Nos. 4–1, Noonday and Bryan lodes, of this survey, respectively, bears N. 18° 43′ W. 51.3 ft.
	Thence N. 25° 06′ E.
324.7	Intersect line 4–5, Sur. No. 17854, Brown lode, at S. 17° 27′ W. 11.34 ft. from Cor. No. 5.
869.74	Intersect line 6–1, Sur. No. 17854, Brown lode, at S. 79° 10′ E. 140.70 ft. from Cor. No. 6, also
	Intersect line 2–3, Sur. No. 17854, Grant lode, at S. 79° 10′ E. 153.73 ft. from Cor. No. 3.
1,006.78	Intersect line 2–3, Sur. No. 12479, A. Am. Queen No. 2 lode, at S. 79° 10′ E. 106.71 ft. from Cor. No. 3.
1,374	To Cor. No. 1, the place of beginning.

SURVEY NO. 20,000 A and B—Continued.

NOONDAY LODE.

Beginning at Cor. No. 1.

A pine post, 4 ft. long, 5 ins. square, set 2 ft. in the ground, with mound of stone, scribed N. 1–20000 A, whence

The NE. Cor. T. 50 N., R. 3 E. of N. M. P. M., bears N. 22° 42′ 10″ E. 9,163.46 ft.

Cor. No. 1, Little Olive lode, of this survey bears N. 2° 32′ 30″ E. 323.3 ft.

Thence S. 68° 18′ W.

FEET.	
29.99	Intersect line 4–1, Little Olive lode, of this survey.
301	To Cor. No. 2.
	A pine post, 4 ft. long, 5 ins. square, set 2 ft. in the ground, with mound of stone, scribed N. 2–20000 A.

Thence S. 14° 17′ E.

647.84	Intersect line 4–1, Little Olive lode, of this survey.
900.16	Intersect line 2–3, Matchless lode, of this survey.
916	Intersect line 3–4, Matchless lode, of this survey.
1,377	To Cor. No. 3.
	A pine post, 4 ft. long, 5 ins. square, set 2 ft. in the ground, with mound of stone, scribed N. 3–20000 A.

Thence N. 68° 18′ E.

250.22	Intersect line 3–4, Mascot lode, of this survey.
301	To Cor. No. 4.
	A pine post, 4 ft. long, 5 ins. square, set 2 ft. in the ground, with mound of stone, scribed N. 4–20000 A.

SURVEY NO. 20,000 A and B—Continued.

NOONDAY LODE—continued.

FEET.	
	Thence N. 14° 17′ W.
416.84	Intersect lines 2–3 and 4–1, Mascot and Matchless lodes, of this survey, respectively.
801.58	Intersect line 2–3, Matchless lode, of this survey.
1,377	To Cor. No. 1, the place of beginning.

BRYAN LODE.

Beginning at Cor. No. 1.

Identical with Cor. No. 4, Noonday lode, of this survey whence

The NE. Cor. T. 50 N., R. 3 E., of N. M. P. M., bears N. 18° 05′ 10″ E. 10,296.64 ft.

Cor. No. 4, Sur. No. 17854, Shields lode, bears S. 12° 06′ W. 845.0 ft.

Cor. No. 4, Sur. No. 17854, Brown lode, bears S. 11° 24′ W. 695.2 ft.

Cor. No. 3, Sur. No. 12479, B. Am. The Cortland Mill Site, bears S. 8° 55′ E. 641.1 ft.

	Thence S. 68° 18′ W.
50.78	Intersect line 3–4, Mascot lode, of this survey.
301	To Cor. No. 2.
	Identical with Cor. No. 3, Noonday lode, of this survey.

SURVEY NO. 20,000 A and B—Continued.

BRYAN LODE—continued.

FEET.	
	Thence S. 11° 55′ E.
694	Intersect S. boundary, Sec. 12, at E. 1,950 ft. from SW. Cor. said Section.
704. 78	Intersect line 4–1, Sur. No. 17854, Shields lode, at N. 59° 28′ E. 49.88 ft. from Cor. No. 4.
834	Wagon road, course Northeast and Southwest.
867. 73	Intersect line 3–4, Penguin lode, unsurveyed, J. M. Flick, claimant, at S. 44° 07′ W. 18.79 ft. from Cor. No. 4.
868. 34	Intersect line 2–3, Sur. No. 17854, Shields lode, at N. 59° 28′ E. 63.51 ft. from Cor. No. 3.
875	Creek 1 ft. wide, flows Southwest.
1,229. 66	Intersect line 1–2, Penguin lode, unsurveyed, at S. 44° 07′ W. 138.82 ft. from Cor. No. 1.
1,493. 52	To Cor. No. 3.
	A pine post, 4 ft. long, 5 ins. square, set 2 ft. in the ground, with mound of stone, scribed B. 3–20000 A.
	Thence N. 68° 18′ E.
301	To Cor. No. 4.
	A pine stump, about 4 ft. high, hewed to 5 ins. square, scribed B. 4–20000 A, whence
	Cor. No. 1, Penguin lode, unsurveyed, bears N. 43° 55′ W, 342.29 ft.
	Cor. No. 3, Pelican lode, unsurveyed, J. M. Flick, claimant, bears N. 43° 42′ 20″ W. 347.7 ft.

SURVEY NO. 20,000 A and B—Continued.

BRYAN LODE—continued.

FEET.	
	Thence N. 11° 55′ W.
357.41	Intersect line 2–3, Pelican lode, unsurveyed, at N. 59° 28′ E. 193.28 ft. from Cor. No. 3.
673.97	Intersect line 4–1, Pelican lode, unsurveyed, at N. 59° 28′ E. 294.70 ft. from Cor. No. 4, also
	Intersect line 2–3, Sur. No. 17854, Shields lode, at N. 59° 28′ E. 376.52 ft. from Cor. No. 3.
688	Intersect S. boundary of Sec. 12 at W. 390 ft. from S. ¼ Cor. said Section.
739.72	Intersect line 3–4, Sur. No. 17854, Brown lode, at S. 79° 10′ E. 298.38 ft. from Cor. No. 4.
812.48	Intersect line 2–3, Sur. No. 12479, B. Am. The Cortland Mill Site, at S. 51° 20′ E. 52.84 ft. from Cor. No. 3.
837.53	Intersect line 4–1, Sur. No. 17854, Shields lode, at N. 59° 28′ E. 362.90 ft. from Cor. No. 4.
938.05	Intersect line 3–4, Sur. No. 12479, B. Am, The Cortland Mill Site, at N. 9° 41′ E. 91.14 ft. from Cor. No. 3.
970	Creek 1 ft. wide, flows Southwest.
1,018	Wagon road, course Northeast and Southwest.
1,344.11	Intersect line 4–5, Sur. No. 17854, Brown lode, at N. 17° 27′ E. 561.11 ft. from Cor. No. 4.
1,447.16	Intersect line 3–4, Mascot lode, of this survey.
1,493.52	To Cor. No. 1, the place of beginning.

LITTLE OLIVE LODE.

Beginning at Cor. No. 1.

A pine post, 4 ft. long, 5 ins. square, set 2 ft. in the ground, with mound of stone, scribed L. O., 1–20000 A, whence

The NE. Cor. T. 50 N., R. 3 E., of N. M. P. M., bears N. 23° 25′ 20″ E. 8,860.6 ft.

SURVEY NO. 20,000 A and B—Continued.

LITTLE OLIVE LODE—continued.

FEET.	
	Thence N. 77° W.
243. 04	Intersect line 4–5, Sur. No. 7153, Little Dora lode, claimant unknown, at N. 50° E., 40.38 ft. from Cor. No. 4.
290. 85	Intersect line 3–4, Sur. No. 7153, Little Dora lode, at N. 23° 05′ W., 39.91 ft. from Cor. No. 4.
291. 72	To Cor. No. 2. A pine post, 4 ft. long, 5 ins. square, set 2 ft. in the ground, with mound of stone, scribed L. O., 2–20000 A, whence Cor. No. 4, Sur. No. 7153, Little Dora lode, bears S. 24° 05′ E. 40.43 ft.
	Thence S. 6° 28′ W.
1503.	To Cor. No. 3. A pine post, 4 ft. long, 5 ins. square, set 2 ft. in the ground, with mound of stone, scribed L. O., 3–20000 A.
	Thence S. 77° E.
272. 4	To Cor. No. 4. A pine post, 4 ft. long, 5 ins. square, set 2 ft. in the ground, with mound of stone, scribed L. O., 4–20000 A.
	Thence N. 7° 12′ E.
430. 39	Intersect line 2–3, Noonday lode, of this survey.
1164. 20	Intersect line 1–2, Noonday lode, of this survey.
1500. 92	To Cor. No. 1, the place of beginning.

Variation at all corners 14° 10′ E.

SURVEY NO. 20,000 A and B—Continued.

LODE LINES.

As near as can be determined from present developments the veins of the several locations embraced in this claim extend as follows from their respective discovery points:

Matchless lode, 458 ft. N. 25° 06′ E., and 558 ft. S. 25° 06′ W.

Mascot lode, 610 ft. N. 25° 06′ E., and 764 ft. S. 25° 06′ W.

Noonday lode, 675 ft. N. 14° 17′ W., and 702 ft. S. 14° 17′ E.

Bryan lode, 347 ft. N. 11° 55′ W., and 1146.52 ft. S. 11° 55′ E.

Little Olive lode, 510 ft. N. 7° 33′ E., and 990 ft. S. 7° 33′ W.

BRYAN MILL SITE SUR. 20000 B.

Beginning at Cor. No. 1, identical with a corner of the location.

A pine post, 4 ft. long, 4 ins. square, set 18 ins. in the ground, in mound of stone, scribed B. M. S. 1–20000 B.

Cor. No. 1 of Bryan lode claim bears N. 87° 15′ E. 600 ft.

The N.E. Cor. of T. 50 N., R. 3 E., bears N. 21° 15′ E. 10515.05 ft.

No bearing objects available.

Thence N. 85° W.

FEET.	
435.6	To Cor. No. 2, identical with Cor. of location.
	A pine post, 4 ins. square, set 18 ins. in the ground in mound of stone, scribed B. M. S. 2–20000 B.

SURVEY NO. 20,000 A and B—Continued.

BRYAN MILL SITE SUR. 20000 B—continued.

FEET.	
	Thence S. 5° W.
500	To Cor. No. 3, identical with Cor. of location. A pine post, 4 ins. square, set 18 ins. in the ground in mound of stone, scribed B. M. S. 3–20000 B.
	Thence S. 85° E.
435.6	To Cor. No. 4, identical with corner of location. A pine post, 4 ins. square, set 18 ins. in the ground, scribed B. M. S. 4–20000 B.
	Thence N. 5° E.
500	To Cor. No. 1, beginning. Containing 5 acres.

AREA.

		Acres.
Total area, Mascot lode		9.463
Area in conflict with—		
Tract "A," hereinafter described	.189	
Sur. No. 12479, A. Am. Queen No. 2 lode	1.375	
Sur. No. 17854, Grant lode	1.629	
Sur. No. 17854, Grant lode (exclusive of its conflict with Sur. No. 12479, A. Am. Queen No. 2 lode)	.514	
Sur. No. 17854, Grant lode (exclusive of its conflict with Tract A)	1.440	
Sur. No. 17854, Grant lode (exclusive of its conflict with Tract "A," and Sur. No. 12479 A. Am. Queen No. 2 lode)	.325	
Sur. No. 17854, Brown lode	.848	

		Acres.
Total area Noonday lode		9.434
Area in conflict with—		
Matchless lode of this survey	2.017	
Mascot lode of this survey	1.188	
Little Olive lode of this survey	1.998	
Total area Bryan lode		10.170
Area in conflict with—		
Tract "B," hereinafter described	.172	
Sur. No. 12479, B. Am. The Cortland Mill Site.	.048	
Sur. No. 17854, Brown lode	1.909	
Sur. No. 17854, Brown lode (exclusive of its conflict with Sur. No. 12479, B. Am. The Cortland Mill Site)	1.861	
Sur. No. 17854, Shields lode	1.114	
Sur. No. 17854, Shields lode (exclusive of its conflict with Sur. No. 12479, B. Am. The Cortland Mill Site)	1.110	
Sur. No. 17854, Shields lode (exclusive of its conflict with Sur. No. 17854, Brown lode)	.976	
Sur. No. 17854, Shields lode (exclusive of its conflict with Tract "B"	.942	
Sur. No. 17854, Shields lode (exclusive of its conflict with Sur. No. 12479, B. Am. The Cortland Mill Site, Sur. No. 17854, Brown lode and Tract "B"	.804	
Penguin lode, unsurveyed	.542	
Penguin lode, unsurveyed (exclusive of its conflict with Sur. No. 17854, Shields lode)	.541	
Pelican lode, unsurveyed	1.681	
Mascot lode of this survey	.027	

	Acres.
Total area Little Olive lode	9.669
Area in conflict with—	
Survey No. 7153, Little Dora lode	.017
Total area Matchless lode	5.694
Area Bryan Mill Site	5.00

FEET.

TRACT "A."

Beginning at a point on line 2-3, Sur. No. 17854, Grant lode, 153.73 ft. from Cor. No. 3, and on line 4-1, Mascot lode, of this survey, at 869.74 ft. from Cor. No. 4. Thence N. 25° 06′ E. 137.04 ft. to a point. Thence N. 79° 10′ W. 54.23 ft. to a point. Thence S. 31° 16′ W. 141.73 ft. to a point. Thence S. 79° 10′ E. 70.00 ft. to the place of beginning, containing 0.189 acre.

TRACT "B."

Beginning at a point on line 2-3, Bryan lode, of this survey, and on line 4-1, Sur. No. 17854, Shields lode, at N. 59° 28′ E. 49.88 ft. from Cor. No. 4. Thence S. 11° 55′ E. 162.95 ft. to a point. Thence N. 44° 07′ E. 18.79 ft. to Cor. No. 4, Penguin lode, unsurveyed. Thence S. 30° 35′ E. 5.60 ft. to Cor. No. 4, Pelican lode, unsurveyed. Thence N. 59° 28′ E. 35.58 ft. to a point on line 2-3, Sur. No. 17854, Shields lode, 117.4 ft. from Cor. No. 3. Thence N. 15° 20′ W. 160.62 ft. to a point. Thence S. 59° 28′ W. 43.81 ft. to the place of beginning, containing 0.172 acre.

The survey of each lode of this location is identical with the respective amended location as staked upon the ground.

LOCATION.

This survey is located in the S. ½ Sec. 12 and the NW. ¼ Sec. 13, T. 50 N., R. 3 E., of N. M. P. M.

EXPENDITURE OF FIVE HUNDRED DOLLARS.

I certify that the value of the labor and improvements made upon, or for the benefit of, each of the locations embraced in said mining claim by the claimant or its grantors is not less than five hundred dollars, and that said improvements consist of:

The discovery cut of the Matchless lode, the face of which, being the discovery point, is on the lode line 458 ft. from a point on line 1-2, 132.47 ft. from Cor. No. 1, 5 ft. wide, 10 ft. face running S. 60° E. 20 ft. to mouth. From the face is a tunnel, 5 x 7 ft., running N. 60° W. 45 ft., thence S. 30° W. 30 ft.

Value of cut and tunnel, $850.

No. 1. The discovery tunnel of the Mascot lode, the mouth of which being the discovery point, is on the center line 610 ft. from center of line 1-2, 5 x 7 ft., running S. 72° 30′ W. 100 ft.

Value, $1,000.

No. 2. A tunnel, the mouth of which bears from Cor. No. 2, Mascot lode, S. 18° 20′ W. 593 ft., 5 x 7 ft., running N. 79° 20′ W. 205 ft.

Value, $2,000.

No. 1. The discovery shaft of the Noonday lode, on the center line 675 ft. from the center of line 1-2, 4 x 6 ft., 45 ft. deep, timbered.

Value, $450.

No. 2. A shaft which bears from Cor. No. 1, Noonday lode, S. 3° 32′ E. 772 ft., 4 x 6 ft., 15 ft. deep.

Value, $150.

No. 3. A tunnel, the mouth of which bears from Cor. No. 4, Noonday lode, S. 77° 10′ W. 152 ft., 5 x 7 ft., running N. 14° 17′ W. 450 ft.

Value, $4,500.

No. 1. The discovery cut of the Bryan lode, the mouth of which being the discovery point, is on the center line 347 ft. from the center of line 1–2, 5 ft. wide, 10 ft. face, running N. 14° W. 15 ft., at the face of which is a shaft 4 x 6 ft., 10 ft. deep.

Value of cut and shaft, $250.

No. 2. A tunnel, the mouth of which bears from Cor. No. 2, Bryan lode, S. 14° 23′ E. 698 ft., 5 x 7 ft., running N. 25° W. 37 ft.

Value, $370.

No. 1. The discovery shaft of the Little Olive lode, on the lode line 510 ft. from a point on line 1–2, N. 77° W. 141 ft. from Cor. No. 1, 4 x 6 ft., 35 ft. deep, timbered.

Value, $350.

No. 2. A tunnel, the mouth of which bears from Cor. No. 4, Little Olive lode, N. 42° 40′ W. 32 ft., 5 x 7 ft., running N. 145 ft.

Value, $1,450.

OTHER IMPROVEMENTS.

A log cabin, the Northwest corner of which bears from Cor. No. 2, Mascot lode, S. 19° W. 565 ft., 12 x 16 ft. Course of long sides S. 10° 40′ W.

A log blacksmith shop, the Northwest corner of which bears from Cor. No. 2, Mascot lode, S. 18° 30′ W. 600 ft., 10 x 12 ft. Course of long sides S. 10° 40′ W. Both belong to claimant herein.

INSTRUMENT.

This survey was made with a C. L. Berger mining transit, No. 3126. The courses were deflected from the true meridian as determined by direct solar observations. The distances were measured with 100-ft. and 400-ft. steel tapes.

REPORT.

The lode line of each location of this claim was run directly upon the ground, and the several corners established by means of offsets from the lode lines. All tie lines were run either directly upon the ground or by traverses, run upon the ground and submitted in a separate report herewith.

The NE. Cor., T. 50 N., R. 3 E., of N. M. P. M., is a granite stone, chiseled with six notches on the East face. Near it are 4 witness trees, blazed and scribed 51–4–31 B. T., 50–3–1 B. T., 50–4–6 B. T., and 51–3–36 B. T. This is the nearest standing corner of the public survey that can be found and identified.

Sur. No. 12479, A. and B. Am. Queen No. 2 lode and The Cortland Mill Site:

All of the corners are pine posts, properly set and scribed with the number of the corner and survey. I find all courses and distances to be correct as approved.

Sur. No. 17854, Grant, Brown, and Shields lodes:

All corners are pine posts, properly set and scribed with the number of the corner and survey. I find all courses and distances to be correct as approved.

Sur. No. 7153, Little Dora lode:

Corners 3, 4, and 5 are pine posts, properly set and scribed with the number of the corner and survey. I find lines 3–4 and 4–5 to be correct as approved.

NOTE.—The amended location certificate of the Mascot lode fails to furnish the course of line 1–2 and the same is properly given in these field notes.

[4—685.]

FINAL OATHS FOR SURVEYS.

LIST OF NAMES.

A list of the names of the individuals employed by O. M. Thayer, United States mineral surveyor, to assist in running, measuring,

and marking the lines, corners, and boundaries described in the foregoing field notes of the survey of the mining claim of the Noonday Tunnel Gold Mining and Milling Company, known as the Matchless, Mascot, Noonday, Bryan, and Little Olive lodes, and Bryan mill site, and showing the respective capacities in which they acted,

D. J. LEHAN, *Chainman.*
....., *Chainman.*
....., *Axman.*
....., *Flagman.*

FINAL OATHS OF ASSISTANTS.

I, D. J. Lehan, do solemnly swear that I assisted O. M. Thayer, United States mineral surveyor, in marking the corners and surveying the boundaries of the mining claim of the Noonday Tunnel Gold Mining and Milling Company, known as the Matchless, Mascot, Noonday, Bryan, and Little Olive lodes, and Bryan mill site, represented in the foregoing field notes as having been surveyed by said mineral surveyor and under his direction; and that said survey has been in all respects, to the best of my knowledge and belief, faithfully and correctly executed, and the corner and boundary monuments established according to law and the instructions furnished by the United States surveyor-general for Colorado.

D. J. LEHAN, *Chainman.*
....., *Chainman*
....., *Axman.*
....., *Flagman.*

Subscribed and sworn to by the above-named persons before me this 28th day of May, 1907.

[SEAL.]

RICHARD ROE,
Notary Public,
Gunnison County, Colorado.

My commission expires December 16, 1908.

[4—686.]

FINAL OATH OF UNITED STATES MINERAL SURVEYOR.

I, O. M. Thayer, U. S. mineral surveyor, do solemnly swear that, in pursuance of instructions received from the United States surveyor-general for Colorado, dated December 1, 1906, I have, in strict conformity to the laws of the United States, the official regulations and instructions thereunder, and the instructions of said surveyor-general, faithfully and correctly executed the survey of the mining claim of the Noonday Tunnel Gold Mining and Milling Company, known as the Matchless, Mascot, Noonday, Bryan, and Little Olive lodes, and Bryan mill site, situate in Gold Brick mining district, Gunnison County, Colorado, in sections 12 and 13, township No. 50 N., range No. 3 E. of N. M. P. M., and designated as survey No. 20000, A and B, as represented in the foregoing field notes, which accurately show the boundaries of said mining claim as distinctly marked by monuments on the ground, and described in the attached copy of each location certificate, which was received by me from the surveyor-general with said instructions, and that all the corners of said survey have been established and perpetuated in strict accordance with the law, official regulations, and instructions thereunder; and I do further solemnly swear that the foregoing are the true and original field notes of said survey and my report therein, and that the labor expended and improvements made upon or for the benefit of each of the locations embraced in said mining claim by claimant or its grantors are as therein fully stated, and that the character, extent, location, and itemized value thereof are specified therein with particularity and full detail, and that no portion of or interest in said labor or improvements so credited to this claim has been included in the estimate of expenditures upon any other claim.

O. M. THAYER,
United States Mineral Surveyor.

Subscribed and sworn to by the said O. M. Thayer, United States mineral surveyor, before me, a notary public in and for Gunnison County, Colorado, this 28th day of May, 1907,

[SEAL.] W. W. McKEE,
Notary Public.

My commission expires December 20, 1908.

AMENDED LOCATION CERTIFICATE, LAW OF 1889.

STATE OF COLORADO, }
County of Gunnison, } *ss:*

KNOW ALL MEN BY THESE PRESENTS, That the Noonday Tunnel Gold Mining and Milling Company, the undersigned, has this 7th day of May, 1906, amended, located, and claimed, and by these presents does amend, locate, and claim, by right of discovery and amended location certificate in compliance with the mining acts of Congress, approved May 10, 1872, and with all subsequent acts, and with section 2409 of the general statutes of Colorado, and with local customs, laws, and regulations, 1,016 linear feet and horizontal measurement on the Matchless lode, vein, ledge, or deposit, along the vein thereof, with all its dips, angles, and variations, as allowed by law, together with 115.12 feet on the westerly and 129 feet on the easterly side of the middle of said vein at the surface, so far as can be determined from present developments, and all veins, lodes, ledges, or deposits, and surface ground within the lines of said claim, 458 feet running N. 25° 06′ E. from face of discovery cut and 558 feet running S. 25° 06′ W. from face of discovery cut, said discovery cut being situate upon said lode, vein, ledge, or deposit, and within the lines of said claim, in Gold Brick mining district, county of Gunnison, and State of Colorado, described by metes and bounds, as follows, to wit:

Beginning at Corner No. 1, whence the NE. Cor., T. 50 N., R. 3 E. of N. M. P. M., bears N. 18° 53′ 20″ E. 9175.32 ft. Thence N. 51° 45′ W. 250.7 ft. to Cor. No. 2. Thence S. 25° 06′ W. 1,016 ft. to Cor. No. 3. Thence S. 51° 45′ E. 250.7 ft. to Cor. No. 4. Thence N. 25° 06′ E. 1,016 ft. to Cor. No. 1, the place of beginning.

This being the same lode originally located on the 23d day of April, 1890, and recorded on the 23d day of July, 1890, in book 64, page 544, in the office of the recorder of Gunnison County. This further and amended certificate of location is made without waiver of any previously acquired rights, but for the purpose of correcting any errors in the original location, description, or record.

THE NOONDAY TUNNEL GOLD MINING AND MILLING COMPANY. [SEAL.]
By EDW. J. BROWN, *Secretary*.

Said lode was discovered the 23d day of April A. D. 1890.
Attest: JOHN FRANKLIN.
Date of amended location May 7, 1906.
Date of amended certificate June 14, 1906.

[BRIEF] No. 108059.

AMENDED LOCATION CERTIFICATE

On the Matchless mining claim of the Noonday Tunnel Gold Mining and Milling Company, in Gold Brick mining district, Gunnison County, State of Colorado.

STATE OF COLORADO, }
County of Gunnison, } *ss:*

I hereby certify that this amended location certificate was filed for record in my office, at 2 o'clock p. m., September 13, 1906, and is duly recorded in book 179, page 66.

J. E. BROTHERS, *Recorder*.
Fees, $..... By F. W. HARPER, *Deputy*.

STATE OF COLORADO, }
County of Gunnison, } *ss:*

I, J. E. Brothers, county clerk and recorder in and for the county of Gunnison, State aforesaid, do hereby certify that the within and foregoing is a full, true, and correct copy of an amended location certificate as the same appears in the records of Gunnison County, in book 179, page 66.

Witness my hand and official seal at Gunnison, this 19th day of November, 1906.

[SEAL.] J. E. BROTHERS, *County Clerk and Recorder*.
By F. W. HARPER, *Deputy*.

ADDITIONAL AND AMENDED LOCATION CERTIFICATE, LAW OF 1889.

STATE OF COLORADO, } ss:
County of Gunnison. }

KNOW ALL MEN BY THESE PRESENTS, That the Noonday Tunnel Gold Mining and Milling Company, the undersigned, has this 4th day of June, 1906, amended, located, and claimed, and by these presents does amend, locate, and claim, by right of the original discovery and this additional and amended location certificate, in compliance with the mining acts of Congress, approved May 10, 1872, and all subsequent acts, and with section 2409 of the general statutes of Colorado, and with local customs, laws, and regulations, 1,374 linear feet and horizontal measurement on the Mascot lode, vein, ledge, or deposit, along the vein thereof, with all its dips, angles, and variations, as allowed by law, together with 150 feet on each side of the middle of said vein at the surface, so far as can be determined from present developments, and all veins, lodes, ledges, or deposits, and surface ground within the lines of said claim, 610 feet running N. 25° 06′ E. from mouth of discovery tunnel, and 764 feet running S. 25° 06′ W. from mouth of discovery tunnel, said discovery tunnel being situate upon said lode, vein, ledge, or deposit, and within the lines of said claim, in Gold Brick mining district, county of Gunnison, and State of Colorado, described by metes and bounds, as follows, to wit:

Beginning at Corner No. 1, whence the NE. Cor., T. 50 N., R. 3 E., of N. M. P. M. bears N. 16° 49′ E. 8,976 ft. Thence N. 64° 54′ W. 300 ft. to Cor. No. 2. Thence S. 25° 06′ W. 1,374 ft. to Cor. No. 3. Thence S. 64° 54′ E. 300 ft. to Cor. No. 4. Thence N. 25° 06′ E. 1,374 ft. to Cor. No. 1, the place of beginning.

65728—09——6

This being the same lode originally located on the 23d day of April, 1890, and recorded on the 23d day of July, 1890, in book 64, page 543, in the office of the recorder of Gunnison County. This further additional and amended certificate of location is made without waiver of any previously acquired rights, but for the purpose of correcting any errors in the original location, description, or record, and of taking in and acquiring all forfeited or abandoned overlapping ground, and of taking in any part of any overlapping claim which has been abandoned, and of securing all the benefits of said section 2409 of the general statutes of Colorado.

Said lode was discovered the 23d day of April, A. D. 1890.

THE NOONDAY TUNNEL GOLD MINING AND MILLING COMPANY.

[INTEREST SEAL.]

By EDW. J. BROWN, *Secretary*.

Attest: JOHN FRANKLIN.

Date of additional and amended certificate June 14, A. D. 1906.

[BRIEF] No. 108060.

ADDITIONAL AND AMENDED LOCATION CERTIFICATE

On the Mascot mining claim of The Noonday Tunnel Gold Mining and Milling Company in Gold Brick mining district, Gunnison County, State of Colorado.

STATE OF COLORADO, } *ss:*
County of Gunnison, }

I hereby certify that this location certificate was filed for record in my office, at 2 o'clock p. m., September 13, A. D. 1906, and was duly recorded in book 179, page 576.

J. E. BROTHERS, *Recorder*,
By F. W. HARPER, *Deputy*.

Fees, $———

STATE OF COLORADO, } ss:
County of Gunnison, }

I, J. E. Brothers, county clerk and recorder, in and for the county of Gunnison, State aforesaid, do hereby certify that the within and foregoing is a full, true, and correct copy of an amended and additional location certificate as the same appears in the records of Gunnison County, in book, 179, page 576.

Witness my hand and official seal at Gunnison, this 19th day of November, 1906.

[SEAL] J. E. BROTHERS, *County Clerk and Recorder.*
By F. W. HARPER, *Deputy.*

AMENDED LOCATION CERTIFICATE, LAW OF 1889.

STATE OF COLORADO, } ss.
County of Gunnison, }

KNOW ALL MEN BY THESE PRESENTS, That The Noonday Tunnel Gold Mining and Milling Company, the undersigned, has this 7th day of May, 1906, amended, located, and claimed, and by these presents does amend, locate, and claim, by right of discovery and amended location certificate in compliance with the mining acts of Congress, approved May 10, 1872, and with all subsequent acts, and with section 2409 of the general statutes of Colorado, and with local customs, laws, and regulations, 1,377 linear feet and horizontal measurement on the Noonday lode, vein, ledge, or deposit, along the vein thereof, with all its dips, angles, and variations, as allowed by law, together with 150 feet on each side of the middle of said vein at the surface, so far as can be determined from present developments, and all veins, lodes, ledges, or deposits, and surface ground within the lines of said claim, 675 feet running N. 14° 17′ W. from center of discovery shaft, and 702 feet running S. 14° 17′ E. from center of discovery shaft, said discovery shaft being situate upon said lode, vein, ledge, or deposit, and within the lines of said claim, in Gold Brick mining district, county of Gunnison, and State of Colorado, described by metes and bounds, as follows, to wit:

Beginning at Corner No. 1, whence the NE. Cor., T. 50 N., R. 3 E., of N. M. P. M. bears N. 22° 42′ E. 9,163.5 ft. Thence S. 68° 18′ W. 301 ft. to Cor. No. 2. Thence S. 14° 17′ E. 1,377 ft. to Cor. No. 3. Thence N. 68° 18′ E. 301 ft. to Cor. No. 4. Thence N. 14° 17′ W. 1,377 ft. to Cor. No. 1, the place of beginning.

This being the same lode originally located on the 24th day of May, 1895, and recorded on the 1st day of August, 1895, in book 132, page 53, in the office of the recorder of Gunnison County, this further and

amended certificate of location is made without waiver of any previously acquired rights, but for the purpose of correcting any errors in the original location, description, or record.

Said lode was discovered on the 24th day of May, A. D. 1895.

THE NOONDAY TUNNEL GOLD MINING AND MILLING COMPANY,

[SEAL.] By EDW. J. BROWN, *Secretary*.

Attest: JOHN FRANKLIN.

Date of amended location May 7, 1906.

Date of amended certificate June 14, 1906.

[BRIEF] No. 108058.

AMENDED LOCATION CERTIFICATE

On the Noonday mining claim of The Noonday Tunnel Gold Mining and Milling Company in Gold Brick mining district, Gunnison County, State of Colorado.

STATE OF COLORADO, } *ss:*
County of Gunnison. }

I hereby certify that this amended location certificate was filed for record in my office at 2 o'clock p. m., September 13, 1906, and is duly recorded in book 65, page 179.

J. E. BROTHERS, *Recorder*.
By F. W. HARPER, *Deputy*.

Fees, $ ———

STATE OF COLORADO, } *ss:*
County of Gunnison. }

I, J. E. Brothers, county clerk and recorder in and for the county of Gunnison, State aforesaid, do hereby certify that the within and foregoing is a full, true, and correct copy of an amended location certificate as the same appears in the records of Gunnison County, in book 179, page 65.

Witness my hand and official seal, at Gunnison, this 19th day of November, 1906.

[SEAL.] J. E. BROTHERS, *County Clerk and Recorder*.
By F. W. HARPER, *Deputy*.

AMENDED LOCATION CERTIFICATE, LAW OF 1889.

STATE OF COLORADO, } ss:
County of Gunnison, }

KNOW ALL MEN BY THESE PRESENTS, That The Noonday Tunnel Gold Mining and Milling Company, the undersigned, has, this 7th day of May, 1906, amended, located, and claimed, and by these presents does amend, locate, and claim, by right of discovery and amended location certificate, in compliance with the mining acts of Congress, approved May 10, 1872, and with all subsequent acts, and with section 2409 of the general statutes of Colorado, and with local customs, laws, and regulations, 1,493.52 linear feet and horizontal measurement on the Bryan lode, vein, ledge, or deposit along the vein thereof, with all its dips, angles, and variations, as allowed by law, together with 150 feet on each side of the middle at the surface, so far as can be determined from present developments, and all veins, lodes, ledges, or deposits, and surface ground within the lines of said claim, 347 feet running N. 11° 55′ W. from mouth of discovery cut and 1,146.52 feet running S. 11° 55′ E. from mouth of discovery cut, said discovery cut being situated upon said lode, vein, ledge, or deposit, and within the lines of said claim, in Gold Brick mining district, county of Gunnison and State of Colorado, described by metes and bounds as follows, to wit:

Beginning at Corner No. 1, whence the NE. Cor., T. 50 N., R. 3 E., of N. M. P. M. bears N. 18° 05′ E. 10,296.6 ft. Thence S. 68° 18′ W. 301 ft. to Cor. No. 2. Thence S. 11° 55′ E. 1,493.52 ft. to Cor. No. 3. Thence N. 68° 18′ E. 301.00 ft. to Cor. No. 4. Thence N. 11° 55′ W. 1,493.52 ft. to Cor. No. 1, the place of beginning.

This being the same lode originally located on the 14th day of September, 1896, and recorded on the 17th day of September, 1896, in book 57, page 530, in the office of the recorder of Gunnison County. This further and amended certificate of location is made without

waiver of any previously acquired rights, but for the purpose of correcting any errors in the original location, description, or record.

Said lode was discovered the 5th day of September, A. D. 1896.

[SEAL.] THE NOONDAY TUNNEL GOLD MINING AND MILLING COMPANY.
By EDW. J. BROWN, *Secretary*.

Attest: JOHN FRANKLIN.

Date of amended location, May 7, 1906.

Date of amended certificate, June 14, A. D. 1906.

[BRIEF] No. 108056.

AMENDED LOCATION CERTIFICATE.

On the Bryan mining claim of The Noonday Tunnel Gold Mining and Milling Company, in Gold Brick mining district, Gunnison County, State of Colorado.

STATE OF COLORADO, } *ss:*
County of Gunnison, }

I hereby certify that this amended location certificate was filed for record in my office at 2 o'clock p. m., September 13, A. D. 1906, and is duly recorded in book 179, page 63.

J. E. BROTHERS, *Recorder*.
By F. W. HARPER, *Deputy*.

Fees, $.....

STATE OF COLORADO, } *ss:*
County of Gunnison, }

I, J. E. Brothers, county clerk and recorder in and for the county of Gunnison, State aforesaid, do hereby certify that the within and foregoing is a full, true, and correct copy of an amended location certificate as the same appears in the records of Gunnison County, in book 179, page 63.

Witness my hand and official seal at Gunnison, this 19th day of November, 1906.

[SEAL.] J. E. BROTHERS, *County Clerk and Recorder*.
By F. W. HARPER, *Deputy*.

AMENDED LOCATION CERTIFICATE, LAW OF 1889.

STATE OF COLORADO, } ss:
County of Gunnison, }

KNOW ALL MEN BY THESE PRESENTS, That The Noonday Tunnel Gold Mining and Milling Company, the undersigned, has, this 7th day of May, 1906, amended, located, and claimed, and by these presents does amend, locate, and claim, by right of discovery and amended location certificate, in compliance with the mining acts of Congress, approved May 10, 1872, and with all subsequent acts, and with section 2409 of the general statutes of Colorado, and with local customs, laws, and regulations, 1,500 linear feet and horizontal measurement on the Little Olive lode, vein, ledge, or deposit along the vein thereof, with all its dips, angles, and variations, as allowed by law, together with 150 feet on each side of the middle of said vein at the surface, so far as can be determined from present developments, and all veins, lodes, ledges, or deposits, and surface ground within the lines of said claim, 510 feet running N. 7° 33′ E. from center of discovery shaft and 990 feet running S. 7° 33′ W. from center of discovery shaft, said discovery shaft being situate upon said lode, vein, ledge, or deposit, and within the lines of said claim, in Gold Brick mining district, county of Gunnison and State of Colorado, described by metes and bounds as follows, to wit:

Beginning at Corner No. 1, whence the NE. Cor., T. 50 N., R. 3. E, of N. M. P. M., bears N. 23° 25′ 20″ E. 8,860.6 ft. Thence N. 77° W. 291.72 ft. to Cor. No. 2. Thence S. 6° 28′ W. 1,503 ft. to Cor. No. 3. Thence S. 77° E. 272.4 ft. to Cor. No. 4. Thence N. 7° 12′ E. 1,500.92 ft. to Cor. No. 1, the place of beginning.

This being the same lode originally located on the 21st day of October, 1889, and recorded on the 7th day of November, 1889, in book 30, page 444, in the office of the recorder of Gunnison County. This further

and amended certificate of location is made without waiver of any previously acquired rights, but for the purpose of correcting any errors in the original location, description, or record.

Said lode was discovered the 24th day of October, A. D. 1889.

[SEAL.] THE NOONDAY TUNNEL GOLD MINING AND MILLING COMPANY.
By EDW. J. BROWN, *Secretary*.

Attest: JOHN FRANKLIN.
Date of amended location, May 7, 1906.
Date of amended certificate, June 14, 1906.

[BRIEF] No. 108057.

AMENDED LOCATION CERTIFICATE.

On the Little Olive mining claim of the Noonday Tunnel Gold Mining and Milling Company, in Gold Brick mining district, Gunnison County, State of Colorado.

STATE OF COLORADO, } *ss:*
County of Gunnison, }

I hereby certify that this amended location certificate was filed for record in my office at 2 o'clock p. m., September 13, 1906, and is duly recorded in book 179, page 64.

J. E. BROTHERS, *Recorder*.
By F. W. HARPER, *Deputy*.

STATE OF COLORADO, } *ss:*
County of Gunnison, }

I, J. E. Brothers, county clerk and recorder in and for the county of Gunnison, State aforesaid, do hereby certify that the within and foregoing is a full, true, and correct copy of an amended location certificate as the same appears in the records of Gunnison County, in book 179, page 64.

Witness my hand and official seal at Gunnison, this 19th day of November, 1906.

[SEAL.] J. E. BROTHERS, *County Clerk and Recorder*.
By F. W. HARPER, *Deputy*.

LOCATION OF MILL SITE.

STATE OF COLORADO, } ss:
County of Gunnison. }

KNOW ALL MEN BY THESE PRESENTS, That The Noonday Tunnel Gold Mining and Milling Company does hereby declare and publish as a legal notice to all the world that it has a valid right to the occupation, possession, and enjoyment of all and singular that tract or parcel of land, not exceeding five acres, situate, lying, and being in Gold Brick mining district, in the county of Gunnison, in the State of Colorado, bounded and described as follows, to wit:

THE BRYAN MILL SITE.

Beginning at Cor. No. 1, whence the NE. Cor., T. 50 N., R. 3 E., bears N. 20° 15′ E. 11,000 ft. Thence N. 5° E. 500 ft. Thence N. 85° W. 435.6 ft. Thence S. 5° W. 500 ft. Thence S. 85° E. 435.6 ft. to Cor. No. 1, the place of beginning, containing 5 acres.

Together with all and singular the hereditaments and appurtenances thereunto belonging.

Witness its hand and seal this 7th day of May, 1906.

[SEAL.] THE NOONDAY TUNNEL GOLD MINING AND MILLING COMPANY.
By EDW. J. BROWN, *Secretary.*

STATE OF COLORADO, } ss:
County of Gunnison, }

I, J. E. Brothers, county clerk and recorder, in and for the county of Gunnison, State aforesaid, do hereby certify that the within and foregoing is a full, true, and correct copy of a location certificate as the same appears in the records of Gunnison County, in book 180, page 76.

Witness my hand and official seal at Gunnison, this 19th day of November, 1906.

[SEAL.]

J. E. BROTHERS,
County Clerk and Recorder.
By F. W. HARPER, *Deputy.*

[4—687.]

SURVEYOR-GENERAL'S CERTIFICATE OF APPROVAL OF FIELD NOTES AND SURVEY OF MINING CLAIM.

DEPARTMENT OF THE INTERIOR,
OFFICE OF U. S. SURVEYOR-GENERAL,

....., ...,
....., 19...

I, United States surveyor-general for ....., do hereby certify that the foregoing and hereto attached field notes and return of the survey of the mining claim of ....., known as the ....., situate in ..... mining district, ... County, ..., in section ....., township No. ....., range No. ....., designated as survey No. ....., executed by ....., U. S. mineral surveyor, ..., 19.., under my instructions dated ....., 19.., have been critically examined and the necessary corrections and explanations made, and the said field notes and return, and the survey they describe, are hereby approved. A true copy of the copy of the location certificates filed by the applicant for survey is included in the field notes.

....., ...,
U. S. Surveyor-General for .....

[4—688.]

UNITED STATES SURVEYOR-GENERAL'S FINAL CERTIFICATE ON FIELD NOTES.

DEPARTMENT OF THE INTERIOR,
OFFICE OF U. S. SURVEYOR-GENERAL,

....,
...., 19...

I, United States surveyor-general for ....., do hereby certify that the foregoing transcript of the field notes, return, and approval of the survey of the mining claim of ....., known as the ....., situate in ..... mining district, ... County, ..., in section ....., township No. ....., range No. ....., and designated as survey No. ....., has been correctly copied from the originals on file in this office; that said field notes furnish such an accurate description of said mining claim as will, if incorporated into a patent, serve fully to identify the premises, and that such reference is made therein to natural objects or permanent monuments as will perpetuate and fix the *locus* thereof.

And I further certify that five hundred dollars' worth of labor has been expended or improvements made upon said mining claim by claimant or ..... grantors and that said improvements consist of ..... and that no portion of said labor or improvements has been included in the estimate of expenditures upon any other claim.

I further certify that the plat thereof, filed in the United States Land Office at ..... is correct and in conformity with the foregoing field notes.

....,
United States Surveyor-General for .....

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